AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Published by Howes Publishing Company, 440 Fourth Avenue, New York

Devoted to the practical application of dyestuffs in all industries; especially to textile chemistry—the science and practice of scouring, bleaching, dyeing and finishing.

Volume XIX | JULY 21, 1930 | Number 12

Colloidal Aspects of the Dyeing of Viscose with Substantive Dyes

By HERMAN BOXSER

THE production of light and dark skeins in the application of substantive dyes to viscose has been a serious problem to the dyer. The cause of this drawback has been attributed to the dissimilar dyeing properties of skeins amongst the various lots of viscose. The latter may be due to a number of causes in the manufacture of the rayon. Chief among these may be (1) differences in the original cellulosic bases (2) varying of the time and temperature in the ripening of the viscose solution, and (3) variances in the tension when spinning the precipitated filaments. The rayon manufacturer has been attempting, through improvements in the process, to eliminate these differences as far as possible. Yet, it has fallen to the lot of the dyer to disentangle himself from the perplexities incurred in dyeing viscose with substantive dyes.

Whittaker (Journal) of Soc. of Dyers and Colourists, 42, 86, 1926) has shown that those dyes which exhibit the least capillary attraction will dye viscose most evenly.

Another singular property of these dyes is that they seem to possess a lower surface tension than the other members of the direct class. If laboratory stock solutions are prepared, their appearances are not unlike those of soap solutions—i. e. possessing a large "head". This surface tension is lowered even to a greater extent by the addition of soap solutions. Thus, the use of the latter, as assistants, will aid in the production of more level dyeings with the substantive dyes on viscose. The neutral vegetable oil soaps, like coconut oil soap, have been found to act best with these dyes.

It is a natural tendency that other agents which possess lower surface tensions should be sought as assistants which would act similarly to the soap solutions. The organic solvents, like the alcohols and ketones, compose the greatest number of this group. Since they exert little solvent action on direct dyes, however, and also are quickly volatilized at low temperatures, they find little use as levelling agents. Glycerine will lower the surface tension of the dye solutions and therefore acts in a manner corresponding to the soap solutions.

Another property, characteristic of those substantive dyes which will not yield light and dark skeins is their great colloidity. Practically all direct dyes are colloids in solution; yet the above mentioned members appear more colloidal than those dyes which produce light and dark skeins. It is a rule that the more colloidal substantive dyes exhibit a much greater natural affinity for cotton—i. e. without the addition of electrolytes. This same phenomenon is very evident with viscose. Therefore, the logical conclusion would be to utilize the more colloidal substantive dyes on viscose without the addition of electrolytes, like NaCl or Na_2So_4. Practical dyeing results show that this is one of the best methods to produce even dyeings on viscose skeins, if the proper temperature regulations are controlled.

Temperature is the most important factor involved when dyeing substantive dyes on viscose rayon. A proper regulation of dyeing temperature will eliminate many dyeing difficulties. In the application of this class to cotton (unmercerized) the use of an improper dyeing temperature will not usually cause any great uneveness in the yarn. But with viscose, in most cases where light and dark skeins are evident, the chief cause may be traced to the improper dyeing temperature.

In structure, viscose is unlike ordinary cotton in that its micelles or "bundles" are not as parallel, but exist in a disorderly arrangement. Hibbert (American Dyestuff Reporter, 14, 1, 1925) describes their appearance as "higgledy-piggledy". It has been the objective of the manufacturers of regenerated celluloses to produce a fiber which is as highly orientated as possible. The more perfect the orientation of the cellulose micelles, the greater will be the tensile strength of the rayon, especially if it is in a wet condition. Clark (Ind. and Eng. Chemistry 22, 5, 1930) substantiates this last statement, from his X-ray studies of the structure of cellulose, when he con-

cluded that, "The tensile strength of rayon should increase with increasing perfection in parallel orientations of the micelles". Recent brands of viscose have approached, to some extent, a more perfect orientation, thus lending to themselves the property of maintaining their strength when wetted. Viscose manufactured by the Lilienfeld process has been the most successful of this type.

Due to the random orientation of viscose, Mark (Melliand 1, 1, 1929) has pointed out there exists a greater "inner surface", than that present in ordinary cotton. The "inner surface" may be defined as the number of OH groups which do not saturate each other in the interior of the crystallite. It may be well to state that it is the OH groups which constitute the "secondary valences", or active forces of cellulose. These "secondary valences" of the OHs determine the fixation of colloidal dye micelles. Thus Mark shows that in the dyeing of viscose, due to the dis-orientation of the latter's micellar groups, the dye particles must penetrate deeply into the fiber to attach themselves to the OHs of the "inner surfaces". The result of this condition is that heavier shades are produced on viscose than on cotton, with the use of the same strength dye solution. This holds true in dye baths in which electrolytes are absent. The above phenomenon is true of mercerized cotton due also to the dis-orientation of its micelles.

The above investigations clarify somewhat the complications of the light and dark skein results when dyeing viscose with a number of substantive dyes. We may assume that those filaments which possess a more parallel orientation of crystallites will dye lighter,—in a similar manner to cotton. A viscose fiber in which there exists a micellar dis-orientation will therefore dye heavier. Thus, the difference in dyeing properties may be attributed to the variance in the micellar arrangements of the viscose fibers.

With these assumptions in mind, it is very evident that in order to improve the faulty dyeing of the rayon, it is necessary to eliminate the fiber and work from the standpoint of the dye solution.

As stated before, practically all the substantive dyes are colloids in solution. At lower temperatures their molecular condition is such that they are present as molecular aggregates,—e. g. as dye micelles. The writer (Melliand 2, 1, 1930) observed from dialysis experiments, that, by raising the temperature of these dye solutions, molecular aggregation is broken down. Many of these colloidal dye solutions revert to a condition not unlike that existant in a true solution. We may also assume that near the boil, substantive dye solutions are most stable.

In order to obtain the best dyeing results on a fiber which is varied in micellar arrangement as viscose, it is logical to maintain that the dye solution should be at its maximum stability,—i. e. near the boil. This would mean that a dye solution would be present which possessed its greatest molecular uniformity. Thus, in dyeing the dis-orientated viscose fiber, the dye micelle would be in a condition of such smallness, that it could easily permeate amongst the innermost crystallites with great facility. Therefore, we would have a uniform distribution of the dye micelles between the crystallites of the viscose fiber.

Let us imagine the antithesis of the above conditions. If the dye solution was at a temperature of 130° F, we may visualize its molecular condition as composed of large colloidal aggregates of dye micelles, the uniformity of which is very questionable. Therefore, there would be present two phases—(1) a fiber possessing micelles which were positioned with much irregularity and (2) a colloidal dye solution possessing micelles, or particles, of whose uniformity we were in doubt. This would be a condition far from ideal, with the liability of irregular dyeing being very imminent.

When the above conclusions were subjected to the tests of practical dyeing in the dyehouse, it was found that they held very true with the group of substantive dyes, known as good "rayon colors". As described previously, they were more colloidal than the other members of the substantive class. Excellent results were obtained in the use of a dyeing temperature of 190° F. Depths of shades as high as 1% were obtainable with fine exhaustion, without the use of salt in the bath.

It is evident that the colloidity of these dye solutions does affect their dyeing properties. On comparing the action of good and poor rayon dyes at 190° F, we noted that the good rayon dyes possessed a much greater natural affinity for the viscose fiber. This would indicate the greater colloidity of the good rayon dyes at 190° F. In other words, their approach to a simple, molecular condition was not as great as the poor rayon dyes. Consequently, the natural question was, "How could this ideal condition of colloidity be attained with the poor rayon dyes?" The answer is simply, temperature. This optimum degree of colloidity will vary considerably amongst poor rayon dyes. Thus, with the majority of the Sky Blues, this condition is present at 150° F, with many direct pinks at 160° F. We would not attempt to name specific substantive dyes and their best dyeing temperatures, since we have experimented with a number, which we consider limited when compared with the numerous direct dyes available. Seibert (American Dyestuff Reporter, 19, 1, 1930) has covered this field to a great extent, and has furnished excellent data in that direction.

It would be well to mention the value of the recent researches of textiles by the use of the X-ray. Most of this work in America has been done by Clark (American Dyestuff Reporter, 19, 2, 1930). Bragg (Cellulose 1, 3, 1930) has also contributed much in this field in England. In his address before the Cellulose Division of the American Chemical Society, Dr. Clark has clearly indicated that the troubles encountered with the differences in tensile strengths and dyeing properties of rayons, would be alleviated through investigations with the X-ray.

The production of a viscose fiber, physically uniform, can only be brought about by a chemical control of its micellar size and orientation. This is the problem of

the rayon manufacturer, to whom the X-ray will prove an invaluable aid. In the meantime, it has fallen to the lot of the dyer to overcome the troubles of light and dark skeins by an intimate knowledge of the characteristics of those substantive dyes, which, when used correctly, will produce excellent results with the rayon.

Elementary Textile Microscopy

Part III—Identifications

True Silk—Tussah Silk—Sea Silk or Byssus Silk—Mercerized Cotton—Kapok—Flax—Hemp—Jute—Ramie—Leaf Fibers—Rayons—Acetate Rayons—Nitro Rayon—Cupra Rayon—Viscose Rayon—Hollow Filament Rayon

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(Continued from issue of July 7, 1930.)

TRUE silk is formed from the secretions of the silk worm which has been fed on the leaves of the mulberry tree. The silk fiber is, in reality, a double fiber bound together with masses of sericin or silk glue—boiling in soap and water dissolves the sericin and separates the two individual fibers.

The middle layers of the cocoon are used for organzine silk, the fibers are round or half-round in cross-section, and the diameters of the single fibers vary from 10 to 21 microns but are generally about 16 microns.

Fig. 52. Silk Fiber (200x)

The outside and the inside of the cocoon cannot be successfully unwound from the cocoon and so are cut into short lengths and carded and spun like cotton. The cross-sections of this part of the silk are more deformed, many of them being triangular in shape.

Tussah Silk

Tussah silk is the secretion of wild worms. The fibers are single and present the appearance of a flat ribbon with longitudinal striations and frequent diagonal, parallel lines. The breadth of the fibers is from 40 to 60 microns. The cross-sections are in the form of flattened circles.

Fig. 53. Tussah Silk Fiber (200x)

Tussah silk is of a grey-brown color which is difficult to remove; and for this reason, is usually dyed a dark color.

Sea Silk or Byssus Silk

This is the beard formed by a certain type of mollusc and is met with only in southern Italy and Normandy where a small trade in braided and woven articles of this fiber is carried on.

Sea silk is of a brown color which may be removed, the fibers are 4 to 6 centimeters long, 40 to 60 microns broad, and 18 to 25 microns thick. The cross-sections are elliptical in shape. The fractures of this fiber are peculiar in that they are always even or in steps and never fibrous. Many fibers have narrow branches projecting from them. The natural ends are rounded.

Cotton

Cotton is the fiber adhering to the seeds of a number of plants of the same family. The color varies con-

TABLE VII

MICROSCOPIC APPEARANCE OF SILKS

	True Silk	Tussah Silk	Sea Silk
Color	White to yellowish	Gray-brown	Brown (may be removed)
Length	Continuous	Continuous	4-6 cm.
Breadth in microns	Single filament, 10-21 mostly 16	40-60	18-25 and 40-60
Cross-section	Round or half-round	Flattened circles	Elliptical
Other characteristics	Transverse fissures in the sericin. Occasional humps or constrictions.	Longitudinal striations. Frequent diagonal parallel lines.	Often twisted. Fractures even or in steps, never fibrous. Very narrow branch fibers. Natural ends-rounded.

siderably—American cotton is white, Sea Island cotton is a cream color, Egyptian cotton is a light brown or coffee color, certain Chinese cottons have a distinct blue tinge, and one South American cotton is reddish. The length of the fiber may be anything up to 5½ centimeters and the breadth is usually from 15 to 22 microns although it may be somewhat under or over these figures in some cases. The walls of the fiber are thick and the lumen or central canal is broad, giving the cotton the appearance of a collapsed twisted tube. The amount and regularity of the twist are important characteristics of the fiber and give it its excellent spinning qualities.

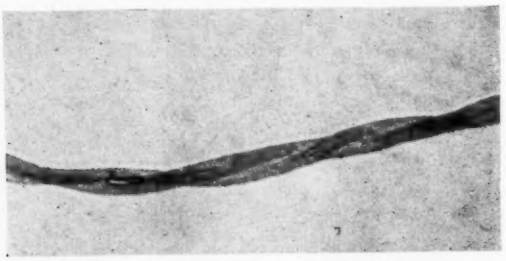

Fig. 54. Cotton Fiber (200x)

A test with aniline sulfate shows that lignin is absent; joints, longitudinal striations and fissures are also absent. The single natural end of the fiber is blunt or rounded.

The cross-section of the cotton fiber is elliptical or crescent in shape, never circular or polygonal, and the lumen appears as a line or very narrow ellipse following the general shape of the cross-section.

Unripe or dead cotton hairs, as well as cotton linters, are short fibers which have died before maturity. They have the appearance of collapsed tubes, but without the twist of mature fibers. These fibers are short, have little strength, and spin very poorly; they are valuable only as a source of cellulose for rayon or nitro-cellulose manufacture.

MERCERIZED COTTON

Mercerization of cotton consists in treating the cotton in the form of yarn or cloth with strong caustic solutions with or without tension. The fiber is swollen, straightened, and the lumen becomes smaller or disappears.

Mercerized cotton is a light brown in color; the fibers are up to 5½ centimeters in length; the breadth is from 20 to 35 microns; and the lumen is narrow, irregular and sometimes invisible. Lignin, joints, longitudinal striations, and fissures are absent; the ends are blunt.

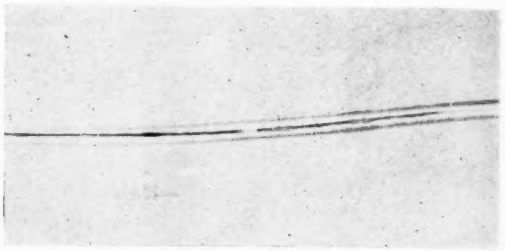

Fig. 55. Mercerized Cotton Fiber (200x)

In cross-section, the mercerized cotton fiber is oval or round, with a small circular lumen.

The general appearance is that of a uniform smooth rod, with frequent humps and depressions corresponding to the twist if the cotton was not under tension during mercerization.

The appearance of mercerized cotton by polarized light has been stated to be characteristic of the degree of mercerization—the absence of strain lines indicating complete mercerization.

KAPOK

Kapok may be taken as characteristic in properties of the class of fibers obtained from the many varieties of plants such as the milk-weed. The true kapok is obtained

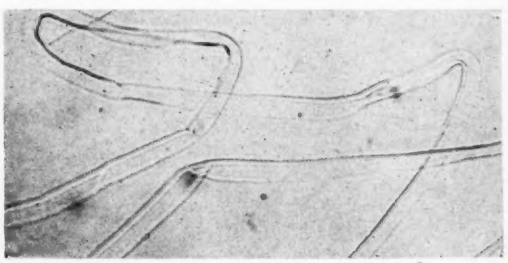

Fig. 56. Kapok Fiber (200x)

from the East Indies and is characterized by a very low density and great resiliency which makes it of value for two special purposes—the stuffing of mattresses, and the manufacture of life preservers. Kapok is not a true textile fiber, since it cannot be successfully spun into yarns and is always used in bulk.

The kapok fiber is yellowish-brown in color, 1 to 3

centimeters in length, and 20 to 37 microns broad. Lignin is always present, as shown by aniline sulfate; but joints, longitudinal striations, and fissures are absent. The general appearance is that of cylindrical tubes with broad lumens, thin walls, and frequent bends which at first glimpse resemble the spirals of cotton. In cross-section, the fiber is oval or round with a large lumen of the same shape and with very thin walls.

TABLE VIII

MICROSCOPIC APPEARANCE OF VEGETABLE FIBERS—SEED HAIRS

	Cotton	Mercerized Cotton	Kapok
Color	White to brown	Light brown	Yellowish-brown
Length in centimeters	Up to 5½	Up to 5½	1-3
Breadth in microns	15-22	20-35	20-37
Lignin	None	None	Present
Lumen	Broad	Irregular in breadth sometimes invisible	Broad
Joints	None	None	None
Longitudinal striations	None	None	None
Fissures	None	None	None
Ends	Blunt, sometimes rounded	Blunt	Blunt
Cross-section, shape	Elliptical or crescent, never circular or polygonal.	Oval or round	Oval or round
Cross-section, Lumen	Line or very narrow	Small, circular	Large
Special	Collapsed, twisted tubes	Uniform smooth rods, humps and depressions if not merc. under tension.	Cylindrical tubes with very thin walls. Frequent bends

FLAX

Flax is obtained from the inner bark of the plant of the same name, and when in the form of cloth is spoken of as linen. The natural color of flax is white, grey, or light yellow according to the source and manner of retting. The fibers are 20 to 150 centimeters in length. 12 to 30 microns broad, and have very narrow lumens except in the case of tow which consists of the short flax fibers and which contains fibers having both broad and narrow lumens.

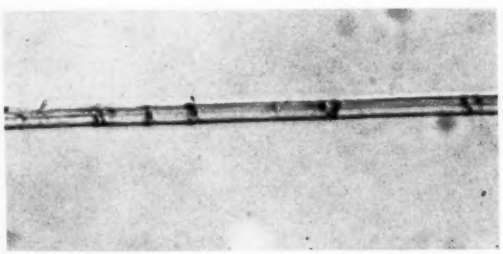

Fig. 57. Flax Fiber (200x)

A small amount of lignin is present in unfinished goods, but is removed by bleaching. The presence of joints gives the fiber a bamboo-like appearance. Longitudinal striations are present, but fissures are absent unless the fiber has been bruised by harsh mechanical treatment, in which case diagonal fissures are formed. The natural ends of the fiber are pointed.

In cross-section, the flax fiber appears as a polygon with sharp angles and a small round lumen.

HEMP

The natural color of hemp is gray, yellow, or brown. The fibers vary in length up to 300 centimeters and are 16 to 50 microns broad, lignin is present in small amounts, and the lumen is broad but often indistinct. Joints and longitudinal striations are present as are both transverse and longitudinal fissures. The natural ends are blunt in shape and sometimes forked, due to the presence of lateral branches which are quite characteristic of the hemp fiber.

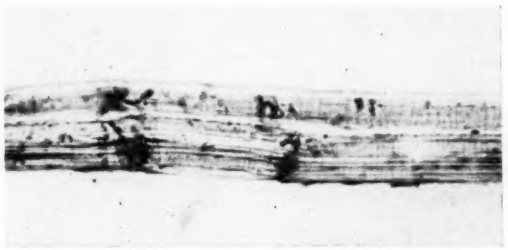

Fig. 58. Hemp Fibers (200x)

In cross-section, the fiber shows as a rounded polygon with a lumen which is cleft-shaped or in the form of an elongated triangle.

Hemp has been used alone or in combination with wool as a wool substitute.

JUTE

Jute is generally of a yellowish or brown color. The length of the fiber is anything up to 300 centimeters,

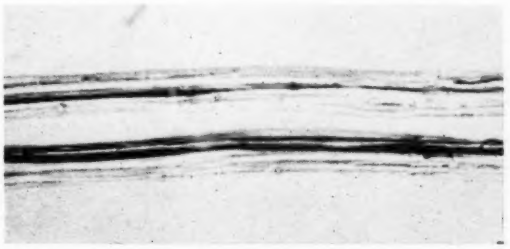

Fig. 59. Jute Fibers (200x)

the breadth is 17 to 23 microns, and the lumen is generally broad but is very variable and often closed entirely. A large amount of lignin is nearly always present, longitudinal striations are present, but joints and fissures are absent. The natural end of the fiber is round.

The cross-section of jute is a sharp polygon with a large oval or round lumen.

Jute is generally used in bagging, coarse mats, and the backs of carpets. Continual efforts are being made to remove the lignin and coloring matter so as to use jute as a general textile fiber, but the attempts to date have been unsuccessful.

Ramie

The natural color of ramie is gray or yellowish; but the decortication or purification of ramie has been successfully accomplished and ramie is frequently found a pure white. In many ways ramie is an ideal textile fiber, but there are a few drawbacks to its general use, notably its uneven dyeing tendency and the brittleness of the fibers. Occasional ramie yarns and fabrics are met with, but usually ramie is found in use as a wool substitute.

The length of the fiber is 15 to 25 centimeters and the breadth is 20 to 80 microns, the lumen is broad, and the

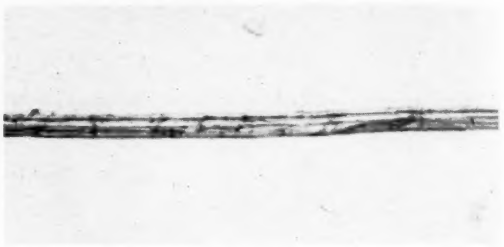

Fig. 60. Ramie Fiber (200x)

natural ends are blunt. Lignin is present, if at all, in very slight amounts; joints and longitudinal striations are present, and both transverse and longitudinal fissures.

The cross-section of ramie is an elongated, rounded polygon with a broad lumen also of a polygon shape and with radial fissures running from the lumen into the walls of the fiber.

TABLE IX

Microscopic Appearance of Vegetable Fibers—Stem Fibers

	Flax	Hemp	Jute	Ramie
Color	White, gray, light yellow	Gray, yellowish, brown	Yellowish	Gray, yellowish
Length in centimeters	20-150	Up to 300	Up to 300	15-25
Breadth in microns	12-30	16-50	17-23	20-80
Lignin	Slight	Slight	Much	Very slight
Lumen	Very narrow	Broad, often indistinct	Broad, variable, often constricted or closed	Broad
Joints	Present	Present	None	Present
Longitudinal striations	Present	Present	Present	Present
Fissures	Diagonal where bruised	Transverse and longitudinal	None	Transverse and longitudinal
Ends	Pointed	Blunt or forked	Round	Blunt
Cross-section, Shape	Sharp polygons	Rounded polygons	Sharp polygons	Elongated, rounded polygons
Cross-section, Lumen	Small, round	Cleft-shaped	Oval or round	Polygons with radial fissures.
Special	Tow has both broad and narrow lumens	Frequent lateral branches		

Leaf Fibers

These fibers derived from leaves of plants are of great importance in the rope and twine industry but of little present importance in the textile industry. Attempts have been made, however, to purify the fibers sufficiently to make a good-appearing fabric and their microscopic appearances are therefore given.

Manila hemp is yellow and comes in various lengths of fiber, the fine fibers being 100 to 200 centimeters long and the coarse fibers up to 700 centimeters. The breadth is 12 to 40 microns, but usually 21 to 30 microns; the lumen is broad and uniform; lignin is present; longitudinal striations are present, joints and fissures are absent; the natural ends are pointed. The cross-section appears as a rounded polygon with a broad rounded lumen.

Sisal hemp is white to yellow in color, 75 to 120 centimeters in length, and from 17 to 28 microns in breadth but usually 22 or 23 microns. The lumen is broad; the natural ends blunt; lignin is present; joints are absent; longitudinal striations and transverse fissures are present. In cross-section, Sisal hemp occurs as a sharp polygon with a lumen in the shape of a rounded polygon. In the crude fiber, crystals of calcium oxalate are often found.

New Zealand flax is 10 to 18 microns broad with a narrow lumen and pointed natural ends. Lignin is present but joints, fissures, and longitudinal striations are absent. The cross-section is round or in the form of a rounded polygon with a small oval or round lumen.

Rayons

The identification of rayons may be accomplished by

TABLE X

MICROSCOPIC APPEARANCE OF VEGETABLE FIBERS—LEAF FIBERS

	Manila-Hemp	Sisal Hemp	New Zealand Flax
Color	Yellowish to brown	White to yellow	
Length in centimeters	Coarse up to 700, fine, 100-200	75-120	
Breadth in microns	12-40, mostly 21-30	17-18, mostly 22-23	10-18
Lignin	Present	Present	Present
Lumen	Broad, uniform	Broad	Narrow
Joints	None	None	None
Longitudinal striations	Present	Present	None
Fissures	None	Transverse	None
Ends	Pointed	Blunt	Pointed
Cross-section, Shape	Rounded polygons	Sharp polygons	Round or rounded polygons
Cross-section, Lumen	Rounded	Rounded polygons	Small, oval or round
Special		Calcium oxalate crystals often present	

four methods, of which two and preferably three should be used in every case:

a. Chemical tests
b. Longitudinal appearance
c. Cross-sectional appearance
d. Appearance under polarized light

The chemical tests used are those given, in the sections on microchemical tests, for nitro and acetate rayons. The longitudinal appearances may be examined in water mounts and the cross-sections by means of the thin rayon condenser.

The examination of rayons by polarized light is more or less in an experimental stage and is complicated by the large number of varieties of viscose rayon. The color formed by polarized light with or without a selenite plate is a function of the thickness, so that the cross-section may be drawn approximately from the longitudinal appearance with polarized light.

ACETATE RAYONS

By far the most common acetate rayon is the Celanese type—the fully acetylated cellulose. In longitudinal view, this rayon shows a narrow false lumen due to an indentation in the fiber. The cross-section is generally of a T or U shape with bulbous ends and no serrations. Modern acetate rayon of this type seems to be tending toward a more compact cross-section with three or more lobes. With polarized light, no interference colors are shown.

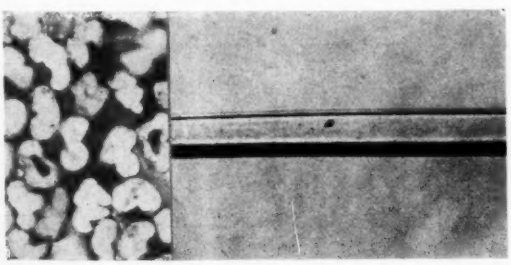

Fig. 61. Celanese Fiber and Cross Section (200x)

A less common acetate rayon is of the Lustron type which is only partially acetylated. This has no false lumen and in cross-section is an elongated oval.

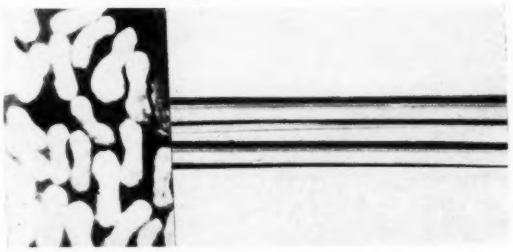

Fig. 62. Lustron Fiber and Cross Section (200x)

NITRO RAYON

Nitro rayon, in longitudinal appearance shows a broad false lumen and with polarized light gives brilliant interference colors. In cross-section this rayon is round or elliptical with one or two indentations and no serrations.

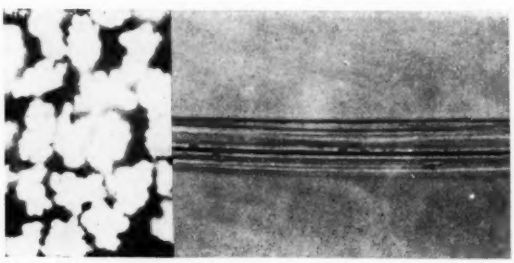

Fig. 63. Nitro Rayon and Cross Section (200x)

CUPRA RAYON

This rayon has a smooth, uniorm appearance with no false lumens or striations; the cross-section is round or

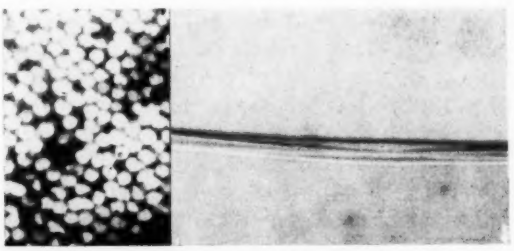

Fig. 64. Cupra Rayon and Cross Section (200x)

elliptical with very few indentations and no serration. By polarized light, the interference colors are generally feeble.

This rayon has been drawn out finer than any of the others by a stretching process.

Viscose Rayon

This type of rayon is manufactured in larger quantities and by a greater number of manufacturers than any other of the rayons, hence the variations in properties of this rayon are greater. This is due, not only to variations in the viscose solution and the spinneret orifices but also to the composition and strength of the precipitating bath.

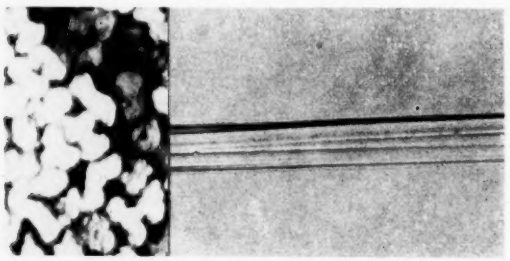

Fig. 65. Viscose Rayon and Cross Section (200x)

The longitudinal appearance shows viscose rayon generally as a flattened ribbon-like fiber with numerous longitudinal striations; the cross-section is of various shapes, but in modern viscose is always serrated. The appearance with polarized light varies. Some give a fair amount of interference colors, some are similar to cupra rayon, and some give practically no color.

A number of authentic samples of rayons, and especially viscose rayons, from different manufacturers is desirable in the examination of rayons if a conclusive result is to be obtained.

Hollow Filament Rayons

To remove some of the luster and give the rayon a silky sheen, viscose is often spun with included gases

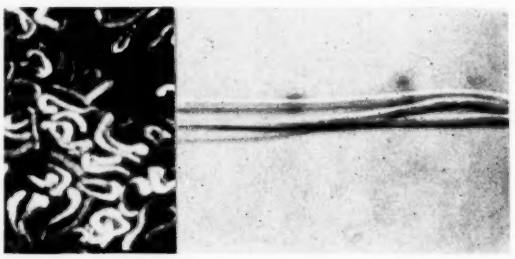

Fig. 66. Celta Rayon and Cross Section (200x)

which after manufacture are removed and cause the fiber to collapse. The longitudinal appearance of this hollow-filament rayon is not very different from ordinary rayon except for a flattened and twisted appearance. In cross-section, this rayon appears as very long, narrow sections with a line in the center.

TABLE XI

Microscopic Appearance of Rayons

	Acetate	Nitro	Cupra	Viscose
Solubility in acetic acid	Soluble	Insoluble	Insoluble	Insoluble
Color with diphenylamine*	No color	Blue	No color	No color
Appearance	Narrow false lumen	False lumen one-third of the diameter.	Smooth uniform. No false lumen or striations	Flattened. Numerous longitudinal striations
Cross-section	T- and U-shaped with bulbous ends. No serrations.	Round or elliptical with one or two indentations. No serrations.	Round or elliptical. Few indentations. No serrations	Various shapes but always serrated. (Modern viscose)
Appearance with polarized light	No interference colors	Brilliant interference colors	Feeble-color changes to complementary color on rotating analyzer	Various — some give two colors, some are same as cupra, some give very little interference color

*A 1 per cent solution of diphenylamine in concentrate sulphuric acid.

(To be continued)

President of National Aniline

Berthold A. Ludwig was recently elected to the presidency of the National Aniline & Chemical Co., Inc. Mr. Ludwig's entire business life has been closely associated with the dyestuff industry since his arrival in this country after the completion of his education in Germany. He first entered the dye application laboratory of Schoellkopf, Hartford & Hanna, in Buffalo and then became affiliated with Wm. J. Matheson & Co., Ltd., and later with its successor, the Cassella Color Company, of which he was technical director for a decade. He was elected vice-president in charge of sales of the National Aniline & Chemical Co., Inc., in 1918 which position he held until becoming associated with the General Dyestuff Corporation in 1925. This past year Mr. Ludwig resigned his post with General to assume the duties of assistant to the president of the Allied Dye & Chemical Co., Inc., whence he came to be called to head the National organization.

Bleaching Cotton Piece Goods in One Boil*

By **THOMAS F. HUGHES**

AT VARIOUS times the writer has been called to bleacheries to remedy some difficulty, and in some plants has taken particular notice of the time consumed in bleaching. One plant goes so far as to let the goods steep 24 hours after singeing. That might have been all right 20 or more years ago, but at the present time, when customers are calling for quick deliveries, the goods may have to be bleached, dyed, printed and finished within 24 hours.

When they are sewed up in the gray and singed, they are taken directly from the singe room to a scouring machine, where they are soured with sulphuric acid at 1-2 degrees Tw., at a temperature of 100 degrees F., into a slide or piler and are then washed directly into a kier. The Allen Patent "Worcester" kier is ideal for this purpose, as it has a superheater that brings the caustic charge to the boiling point without any condensed steam entering the liquor, thereby keeping the caustic at full strength until exhausted.

The Boiling Process

After the goods are soured and washed in the kier, they are ready for boiling, and a charge is made of caustic soda, and soda ash, to stand at 4 degrees Tw. and to this is added 8 pounds of a good kier oil and 5 pounds bisulphite of soda to help expel the air from the kier and prevent oxycellulose. Enough water is now added to float the cloth, and the pump is started with the cover off, so that one may be sure the right circulation is taking place. The cover is then put in position and clamped down, the air vent being left open until all air is expelled from the kier, but when it is nearing the boiling point the vent can be shut. The reducing valve should be set to keep the kier at 20 pounds pressure and the blow-off valve at 25.

This kier also has an arrangement by which water may be forced in at the bottom and blown off at the top, preventing scum and other material taken from the cloth being washed from the top, in place of the old way of opening the blow-off valve and washing all foreign matter down through the cloth again. (See Fig. 1.) Wonderful results can also be obtained if the wash-water is heated by steam, as it enters the kier first, before washing with cold water, because this will prevent stains of many kinds if the cold water comes in direct contact with the waxes, gums, etc., taken from the fiber during the boiling process.

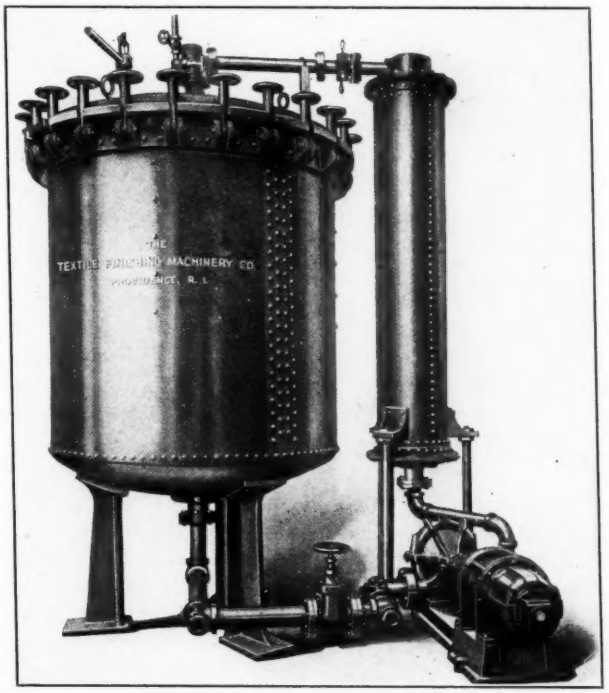

Fig. 1. Motor Pump and Heater Kier

Length of Time in Kier

The goods should be boiled nine hours after the kier has reached the boiling point, as in this type of machine the circulation is very rapid, and since the liquor enters the heater before entering the kier, the boiling point is easily reached. Some plants boil kiers for 12 or 14 hours, but in an Allen Patent "Worcester" kier the caustic charge is exhausted in 9 hours, and you get a perfect absorbent bleach in one boil. Goods that are very heavy, such as broadcloth and drills, may be boiled in one kier for 9 hours, and then just reeled into another kier and given 7 hours boil with a caustic charge as above, only the charge should be of such concentration on entering the kier, that

*In the preparation of this article the author wishes to give credit to Part II of Textile Chemistry and Dyeing by L. A. Olney, which has been used as a reference.

when made up with water, so that the cloth will float, it will be of the proper strength.

It is well to have a kier boiler in each plant who understands the kier he is working, but with an Allen "Worcester" kier this part of the work can be done by the night watch as the machine is so simple to operate that there is no fear of the circulation stopping, which would cause the liquor to remain stagnant during the night or when the kier is not in operation.

The Essential Process

It is in the kier that the main process essential to the production of white goods is performed, and this work cannot be carried out successfully unless the kier is kept in proper circulation, and at the right number of pounds, as stated. Some plants are still working with the old-style open kiers, and others with injectors of various makes but in practically all of these kiers the goods are given 12 and 14-hour boils and are boiled twice, wasting a great deal of time, money, and labor.

Interruption of Circulation

It is a well known fact that much difficulty is often experienced in obtaining uniform and regular circulation in an injector kier. The injector stops or gets caught, and the result is imperfect boiling, and consequently imperfect bleaching.

The conditions leading to interruption of the circulation are as follows: I. If the temperature rises higher than is desired, for any reason, the steam must be turned off, and necessarily the circulation immediately stops. 2. If for any reason a higher temperature is desired, more steam must be turned on, and finally the liquor becomes so hot as to stop circulating, and little else but steam passes through the circulation pipe, which causes the kier to show several pounds pressure in a very few minutes. This is very dangerous to the top of the goods, as they may get dry and tender and the same applies in case of their coming in contact with hot sides of the kier. 3. There is a tendency for the circulation to stop or become irregular when there is not enough difference between the pressure of the steam entering the injector and the pressure of the steam in the kier.

Centrifugal Pump Circulation Remedies Trouble

In the Allen Patent "Worcester" kiers these difficulties are overcome. The circulation seems to be very regular, and the period of boiling is reduced to a minimum. In addition to the above, this keir may be said to possess the advantages of all other kiers for quickness of boil and even circulation, and is very economical in the amount of steam used. This Allen kier may be run by a pump with tight and loose pulley, but the method adopted by most plants is to have a centrifugal pump large enough to pump the whole body of liquor through the kier in circulation every 15 minutes.

The great feature of this kier is that positive circulation is assured at all times, and the liquor is not diluted by the large amount of steam that is constantly entering through an injector. This type of kier has met with great favor.

Care of Kiers

When iron kiers are new, there is more or less fear of rust, but after they have been in use a while the interior becomes covered with a hard coating from the caustic and soda ash. It is well to frequently give them a coat of whitewash on the inside. Cement may also be used, and after two coats have been applied and allowed to dry hard, this is gone over with a heavy coat of silicate of soda which makes a hard polished surface, which will prevent further oxidation.

Use of Open Kiers

When the kiers are used open, as in the boiling of rayon, and colored yarn goods in soap, it is absolutely necessary that the material being bleached should be held down below the surface of the liquor, for if the cotton material in the presence of an alkali comes in contact with the air at a high temperature, tendering will take place. For this purpose chains are used that fasten to the sides of the kiers, so as to keep the goods under the liquor at all times.

The amount of liquor necessary to fill a kier to the proper point for the boiling after the cloth has been introduced is not usually large, as each piece of cloth carries approximately one gallon of water with it as it enters the kiers from the washers, but, of course, some of this is lost by drainage as the kier is piling up with the bottom valve open. It is well to take great care in packing the goods into the kier, for a poor circulation is often the result of poor packing. Another trouble which may result from careless packing or poor circulation might be termed the turning over of goods in the kier.

To Relieve Undue Pressure

Under certain conditions too great a pressure beneath the goods as compared with that above is attained all at once, and if this inequality of pressure cannot be relieved through natural channels a large quantity of steam will often rush up through the goods, disarranging and overturning them to such extent as to disturb the process and seriously interfere with their removal from the kier. Whenever this happens, it is well to shut the bottom valve in the kier, fill it (the kier) with water until the cloth floats and runs out through a small squeezer wet, until the kier is empty. The cloth floating in the kier comes out more easily than if it were allowed to stand in a solid mass.

Another feature of the kier mentioned is the sprayer inside it which keeps the goods on top in a wet condition at all times, while the emulsion formed with the caustic soda ash and kier oil keeps the goods from drying out even if the circulation pump should stop for any reason. There are several other points that the bleacher will soon find out for himself which could be brought up for special attention in the operation of the kier.

Mercerizing and Other Processes

The next process is to take the goods from the kiers and wash, sour at 1 degree Tw., wash to the bins and mercerize. For light goods treated this way, and that are to be mercerized and dyed, no chemicking is needed unless they are going for white. After they are opened in a

"scutcher" they are not to be put back in rope form again. If for mercerizing, they are mercerized wet, then washed, soured and washed at the end of the mercerizing frame, in the last wash box a small compartment is made in which soda-ash liquor is kept, to neutralize any acid left in the cloth.

They are then taken to the drying cans to be dried, and then to the pads to be dyed, or if for jigs, they are taken to the dye-house wet, and run into rolls for jig dyeing. Goods going for white are taken to the bleach house, where they are given a light chemic, allowed to stand until fully developed, then washed on a slide or piler through a squeezer containing sulphur dioxide, and given a good wash to the white lines.

Goods singed in the afternoon are run into the kier, boiled nine hours, taken out in the morning, washed, soured and washed, mercerized wet, dried, and dyed, on pads or jigs. They should be ready to ship the same afternoon at four o'clock.

The author put this process in operation in a New York plant, and as they take no outside work, every piece of goods is papered, and those that come out of the kiers in the morning are on the way to the storehouse or shipping room in the afternoon. When one stops and thinks that this is in the bleaching, dyeing and finishing business, and then looks back at his own plant, letting goods stand 24 hours to steep, and 12 and 14 hours to boil in his kiers, he should start a little more thinking about making a change, if he wishes to keep up with the other fellow.

The Old Style Kier

Figure 2 shows the old style "vomit kier" that is still

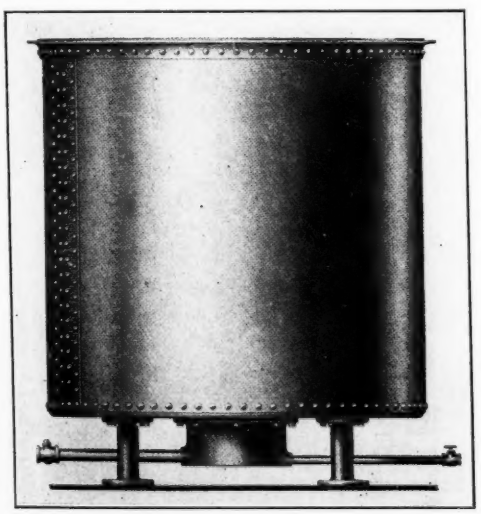

Fig. 2. Open Kier

in use in some plants. The operation of this kier according to present-day methods is very expensive, but they are gradually going out of existence, to be replaced by up-to-date apparatus or changed over by the addition of the super-heater and the electric pump circulation system. The great loss of heat from the old style vomit kier by radiation, and the large amount of steam necessary to keep up the circulation led to the introduction of the first Allen kier, which has been operated with considerable success.

This kier is of the injector type, but entirely does away with the central vomit pipe, having in its place four symmetrically located external pipes which extend from the well at the bottom of the kier to the top entering near the side, thus leaving the center of the top clear for a manhole. Each of the four pipes is provided with an injector, and after entering the kier at the top, flattens out into a fan-shaped nozzle which showers the liquor upon the surface of the goods. The circulation and boiling systems are wholly independent of each other, and one valve for each is all that is required. Each vomit pipe is provided with a telltale which indicates the condition of the circulation. This type of Allen kier is economical in the amount of steam used, the circulation is rapid and strong, and with proper management gives excellent results.

Objection Overcome

However, the objection to this type of kier is that it has the injector system, which causes steam to enter the liquor and reduces it before the full strength caustic liquor that has been made up for the kier has had a chance to do the work intended. The Allen Patent "Worcester" kier has overcome all this by the introduction of the superheater, and the swiftness of the circulation without any steam entering the caustic charge produces a perfect absorbent while in one 9-hour boil, a white that will stay white, and not turn yellow on the shelves or in cases.

Too much stress cannot be laid on the importance of careful and thorough washing of the material at the different stages of the bleaching process, and particularly after it has been completed, for in many cases deterioration and tendering of the cloth might be traced to insufficient washing rather than too strong liquors. For satisfactory results it is imperative that all acid and chlorine should be removed from the cloth at the proper time, and it should also be remembered that heat is many times generated by the action of one chemical upon another, which in some cases is enough to cause tendering unless it is overcome by immediately passing the cloth into an excess of water.

Washing Machines

The commonest forms of washing machines consist of large cisterns through which water can be passed with varying rapidity, and some means of passing the cloth through them, so that every portion will come in contact with a large volume of water. The machines are commonly constructed with two heavy squeeze-rolls above the cistern, which vary in diameter. The lower roll is commonly the largest being from 20 to 24 inches in diameter while the upper roll is from 12 to 18 inches in diameter.

There should be enough pressure between them to draw in the wet cloth without slipping. The speed at which the cloth is passed through the washing machine depends on the nature of the material, the construction of the machine, and the number of times the cloth passes through the squeeze rolls. For an ordinary machine, with print cloth, the rate is from 3 to 5 miles per hour. With certain

tension machines this may be increased somewhat, but with very heavy material the speed is sometimes reduced to as low as one mile per hour. In any event, the washing should always be thorough enough to remove the last traces of acid, or the material will become tender when dried. After the final wash, the cloth is hydro-extracted, or passed between squeeze rolls and then brought again to full width. It is sometimes opened by hand, but a scutcher is more commonly used for this purpose. Scutchers vary in construction and working detail, but all involve the principal of producing a stretching of the cloth from the center toward the edge by passing it over spirally grooved or fluted rolls, or diagonally grooved surfaces. The finishing of cotton piece goods, being a subject by itself, will not be further considered here.

Correspondence

VANITY FAIR SILK MILLS
Reading, Pa.

June 23, 1930.

American Dyestuff Reporter,
440 Fourth Avenue,
New York City.

Gentlemen:

We are interested in finding out if we could eliminate the human eye in matching shades on various fabrics and substitute the photo-electric cell in its place.

We understand that it is being done in some mills for matching shades on various materials, but do not know if it is applicable to the textile industry such as matching hosiery, etc.

If you can give us any information on the question, or can refer us to some one who can, we would greatly appreciate same. Thanking you for any information on the above questions, we are,

Yours very truly,
VANITY FAIR SILK MILLS,
W. S. Grill.

AMERICAN DYESTUFF REPORTER
NEW YORK, N. Y.
Office Directing Editor,

June 27, 1930.

Vanity Fair Silk Mills,
Reading, Pa.

Gentlemen:

Your letter of June 23rd to the American Dyestuff Reporter has been referred to me for reply.

The time has not yet arrived when you can wholly eliminate the human eye in matching shades and reproducing them upon textile material. If you simply wish to reproduce in graph form, or in other words, get the exact specification of a color in term of wave lengths, this can be done very accurately by the use of a colorimeter or spectrophotometer, of which there are several upon the market. Such a procedure does produce a chart or diagramatical representation of the color more accurately than the eye alone could ever do. Unfortunately however any attempt to use such data to reproduce the color upon textile material in a dyehouse, the same as a machinist or carpenter would use a blue print or working drawing to produce a machine or construct a building does not work out at all.

Up to the present time no one has been able to eliminate the human eye in reproducing colors on textile materials and it will be a long time before this can be accomplished.

Many difficulties immediately arise when one attempts, as you might say, to take a blue print of a color and from that reproduce the exact color upon textiles.

There are too many variables such as temperature, concentration and time, also specific properties of the dyes available which enter into the whole procedure, and must be taken into consideration while the dyeing operation is in progress. For this reason the use of the human eye in combination with a thorough knowledge of the properties of the individual dyes being used are so far the only practical means of satisfactorily reproducing colors on textiles. The use of the spectrophotometer and colorimeter would of course determine whether or not you had reproduced exactly the same color as the pattern.

It is possible that this letter may have been suggested through a review of a book entitled "Exact Color Matching and Specifying" by L. Blin Desbleds, which was published in the November 11, 1929 edition of the American Dyestuff Reporter. If you have not seen this and have this number of the Dyestuff Reporter at hand, I should advise you to read it.

Very truly yours,
Louis A. Olney.

Change in General Officers

It was recently announced that Colonel Herman A. Metz has assumed the chairmanship of the Board of Directors of the General Dyestuff Corporation and that Ernest A. Halbach has succeeded Col. Metz as president of the company.

Mr. Halbach has the distinction of having been connected with one concern and its successors throughout his business career of thirty-one years. Upon the completion of his education he entered the Boston office of Wm. Pickhardt & Kuttroff, and later was transferred to the New York office of Kuttroff, Pickhardt & Co., Inc., where he became manager and a director of the company. He acted as sales manager from January, 1922, until December 31, 1925. When the General Dyestuff Corporation was formed Mr. Halbach was appointed secretary, and subsequently general manager in 1926.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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Newport Chemical Works, Passaic, N. J.

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WILLIAM R. MOORHOUSE — WALTER M. SCOTT

Past President and Chairman of the Research Committee
LOUIS A. OLNEY
Lowell Textile Institute, Lowell, Mass.

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Harold C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

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A. M. Burt, Chairman, 1046 Public Ledger Building, Philadelphia, Pa.
Percival Theel, Secretary, Philadelphia Textile School, Philadelphia, Pa.

Piedmont Section—
R. M. Mitchell, Chairman, 808 Cypress Street, Greensboro, N. C.
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R. S. Wheeler, Chairman, Crystal Springs Bleachery, Chickamauga, Georgia.
Lee Roy Hiller, Secretary, Crystal Springs Bleachery, Chickamauga, Ga.

Midwest Section—
Carl E. Bick, Chairman, Real Silk Hosiery Mills, Indianapolis, Ind.
William Bergh, Jr., Secretary, Vassar Swiss Underwear Co., Chicago, Ill.

Lowell Textile Junior Section—
Earle R. McLean, Chairman: Alfred J. Carbone, Secretary.

North Carolina State College Junior Section—
R. A. Gilliam, Chairman, E. B. Hardin, Secretary.

SIXTIETH MEETING OF THE RESEARCH COMMITTEE, JUNE 26, 1930

THE SIXTIETH Research Committee Meeting of the American Association of Textile Chemists and Colorists was held at the Engineer's Club, Boston, Mass., on Friday afternoon, June 26th, 1930, the following members being in attendance:

L. A. Olney, *Chairman*

W. S. Williams	J. F. X. Harold
W. M. Scott	W. C. Smith
H. Meyer	H. Christison
R. H. Culver	B. L. Hathorne
H. W. Leitch	C. Z. Draves
W. E. Hadley	W. H. Cady

The following sent their regrets at not being able to attend:

A. M. Burt	W. R. Moorhouse
K. R. Moore	H. D. Clayton
E. F. L. Lotte	W. D. Appel

It being impossible for Mr. Morrison to attend the Research Committee Meeting, W. E. Hadley was appointed Secretary pro tem.

The compilation of data for the coming year book was discussed at length.

Mr. Smith stated that the wool and silk fastness committee have adopted lists of dyeings to be used as standards in fastness trials. The preparation of cotton samples to be used as standards is well under way, it only remaining to select the proper dyes for the higher class of fastness. It is believed that these lists will be in readiness for the coming Year Book.

COMMITTEE ON FASTNESS OF WOOL

Mr. Christison stated that fulling tests were being conducted with both the Abbott machine and the Launderometer. The work with the Abbott machine has been temporarily discontinued, but the work with the Launderometer is progressing favorably.

Owing to the highly viscous character of the soap solution used for practical fulling, some trouble has been experienced due to the sticking of the material in the containers. It was suggested that false ends could be soldered into the containers or that a series of nail heads in the ends would serve to prevent the suction of the material and thus give free agitation. Mr. Smith stated that he had used small shot outside the bags, but that this was not successful.

Mr. Smith felt that a more dilute soap solution would prevent sticking, but this would present somewhat different conditions than found in practice.

Mr. Christison is to present a further report, which is to be ready by August first.

Committee on Silk Fastness

Dr. Scott reported that standards were being prepared to show the various types of fastness.

At the last annual meeting in Philadelphia, the committee was authorized to go ahead with the preparation of silk cloth to be used as standards.

It was found impracticable to dye the silk in the piece and consequently a sufficient quantity of silk yarn to weave fifty yards each of the four standards has been prepared. The cloth is being woven at the Lowell Textile Institute. Class 1—5% dyeing of Ciba Blue 2B. Class 2—2% Erio Chrome Azurole B. Class 3—Formyl Violet S4B. Class 4—2% Patent Blue A.

The size and cost of the samples, which will be available for distribution, will be decided at the Fall meeting. Dr. Scott stated that a report of his committee will be available for the Year Book by August first.

Committee on Fastness to Perspiration

Mr. Christison stated that a committee from the Society of Dyers & Colorists have worked with medical men and hospitals in an effort to determine the chemical composition of perspiration, but as far as he is aware no practical tests for the determination of the action of perspiration upon textile material have been prepared by them.

It was decided to request Dr. H. C. Chapin to determine the pH value of the alkaline and acid solutions, which the Association have recommended for perspiration tests.

Committee on Fastness of Textile Material to Acid and Alkali

No changes are noted in this connection.

Committee on Carbonizing of Textile Material

No changes to be reported.

Committee on Fastness to Crocking

No changes to be reported.

Committee on Waterproofing Standards

Dr. Harold stated that certain improvements have been made in the apparatus used for testing the quality of waterproofing, and that a report would be ready for the coming Year Book.

Committee on Rubberized Fabrics

Mr. Christison stated that streaks and clouds appearing in piece goods had been traced to copper in the material which had acted as a catalyst.

Committee on Research Survey

A short time ago Mr. Appel presented a comprehensive diagram outlining the various phases of research problems. It was expected that this would be amplified for publication in the 1930 Year Book.

Committee on Bibliography

The list of books relating to textile chemistry, bleaching, dyeing, finishing and printing, appearing in the 1929 Year Book will be revised and classified under ten or twelve headings for publication in the 1930 Year Book.

In addition a list of important articles appearing in the literature during 1929 will be published.

Committee on Color Standardization

Dr. Scott, chairman, reported that the Bibliography of the whole subject of Color Standardization was in preparation and would be ready for the Year Book.

Committee on Shrinkage of Textile Material

Committee reported progress.

Committee on Standard Methods of Determining Sizing and Finishing Material in Textile Fabrics

Samples of specially finished fabrics have been sent to several different laboratories in order that the method proposed might be tried out by different chemists for their approval or criticism.

Committee on Rayon

B. L. Hathorne, newly appointed Chairman of the Committee, was present and a discussion took place relative to the work already proposed for the committee.

Mr. Hathorne is to present, and have ready for publication in the Year Book, a method for identification of the different types of rayon.

Committee on Fastness to Light

Mr. Cady pointed out that it seemed unnecessary to prepare an extended report of the Light Fastness Committee for publication in the Year Book inasmuch as a similar report more up-to-date was always presented at the Annual Meeting, and complete reports published from time to time in the Proceedings. It was suggested however that a list of references of the different reports in the Proceedings be published in the 1930 Year Book.

A statement will also be printed regarding the relative value of sunlight in comparison with the Fadeometer. Work is being conducted at the present time comparing the results obtained with the Fadeometer of the Atlas Electric Devices Company; the modified Fadeometer of the Pease Laboratories, and the Fugitometer as used in England with sunlight.

Reference was made to a letter which was received from the Atlas Electric Devices Company relative to the revision of directions for operation of the Launderometer. This was referred to the Chairman of the Research Committee.

Respectfully submitted,

W. E. Hadley,

Secretary pro tem.

SIXTY-FIFTH COUNCIL MEETING, JUNE 27, 1930

THE SIXTY-FIFTH Council Meeting of the American Association of Textile Chemists and Colorists was held at the Engineers' Club, Boston, Mass., Friday afternoon, June 27, 1930.

In the absence of the President, Vice-President Walter S. Williams called the meeting to order about 3:20 P.M. Others present were:

Councillors: Hugh Christison, Ralph F. Culver, Walter M. Scott.

Councillors (ex-officio): L. A. Olney.

Secretary: Alex. Morrison.

The reading of the minutes of other meeting was waived.

The Secretary's balance sheet was read as follows and approved:

Financial Report of Secretary—June 26, 1930

Cash on hand 4/30/30	$511.91
Receipts 4/30/30 to 6/26/30:	
Applications (27 @ $5.00)	135.00
1930 Dues (56 @ $5.00)	280.00
1929 Dues (2 @ $5.00)	10.00
1928 Dues (1 @ $5.00)	5.00
1927 Dues (1 @ $5.00)	5.00
1926 Dues (1 @ $5.00)	5.00
Corporate Dues	200.00
Atlas Electric Devices Royalties	33.00
Howes Publishing Co. (Reporters)	3.75
Pin	1.45
Misc. Sales (Reporters)	6.50
Year Books	14.00
Light Fastness Reporters	2.00
	$1,212.61
Disbursements:	
4/7/30 to Treasurer—Research Fund	$212.00
5/14/30 to Treasurer—General Fund	550.00
Exchange Charges	.86
Cash on hand—Andover Nat'l Bank	394.75
Cash on Hand	55.00
	$1,212.61

The following were elected to membership:

Active

Becker, Edmund C., 1745 West Market St., Fairlawn, Ohio. Prop., City Dye Works, 905 Miami St., Akron, Ohio.

Diener, Walter M., Y.M.C.A., Pottstown, Pa. Superintendent, Spring City Bleach & Dye Works, E. Bridge St., Spring City, Pa.

Duncan, James R., Box 5, Clearwater, S. C. Colorist, Clearwater Mfg. Co., Clearwater, S. C.

Gherardi, Mario., Directeur Chimiste, Imprimerie Marrom's Torre Pellice (Torio) Italie.

Harlan, W. R., Apt. 7, 1211 E. Boulevard, Charlotte, N. C. Chemist, Stein, Hall & Co., Inc., 908 Johnston Bldg., Charlotte, N. C.

Johnson, B. S., Supt., Read Hosiery Mills, McMinville, Tenn.

Kirk, Walter C., 345 E. Crosier St., Akron, Ohio. Dyer, City Dye Works, 905 Miami St., Akron, Ohio.

Marler, T. J., Cleveland, Tenn. Chemist and Salesman, Manufacturer's Soap & Chemical Co., Cleveland, Tenn.

Nuttall, R. H., 2225 Central Ave., Augusta, Georgia. Supt., Clearwater Mfg. Co., Clearwater, S. C.

O'Byrne, Thomas, Box 33, Clearwater, S. C. Color Shop, Clearwater Mfg. Co., Clearwater, S. C.

Otto, Paul Markus, 559 Lexington Ave., Clifton, N. J. Chemist, Botany Worsted Mills, Passaic, N. J.

Partington, Edward J., 636 Newport Ave., So. Attleboro, Mass. Dyer, Guyan Mills, Valley Falls, R. I.

Pingree, Raymond A., 9 Woodland St., Saylesville, R. I. Textile Chemist, U. S. Finishing Co., Providence, R. I.

Sledge, W. T., 5 Long Apts., Chattanooga, Tenn. Dyer, Miller Smith Hosiery Co., Chattanooga, Tenn.

Wilson, Edwin A., 52 Walnut St., Rutherford, N. J. Chemist, National Silk Dyeing Co., Paterson, N. J.

Winnell, Lloyd H., 30 West 96 St., New York, N. Y. Salesman, National Aniline & Chemical Co., 40 Rector St., New York, N. Y.

Junior

Cobb, Leslie L., Roanoke Rapids, N. C. Overseer, Dyeing & Bleaching, Roanoke Mills Co., Roanoke Rapids, N. C.

Lipschitz, Louis, 267 Union St., Fall River, Mass. Student, Bradford Durfee Textile School, Fall River, Mass.

Stacey, Alfred C., 9 Brook St., Andover, Mass. Chemist, American Woolen Company, Washington Mills, Lawrence, Mass.

Wright, Frank A., P. O. Box 183, Thomaston, Ga. Dyer, Thomaston Bleachery, Thomaston, Ga.

Associate

Dorsett, R. R., 1709 S. Boulevard, Charlotte, N. C. Salesman and Demonstrator, 1109 Independence Bldg., Charlotte, N. C.

Morrison, Harry H., Eastern Hotel, Chattanooga, Tenn. District Sales Engineer, Permutit Co., 1013 Provident Bldg., Chattanooga, Tenn.

Riva, Paul J., 183 East 18th St., Paterson, N. J. Dyer, Geade Silk Dye Co., River St. and 4th Ave., Paterson, N. J.

Sheron, Norman H., Mahwah, N. J. Salesman, J. S. Young & Co., 245 Broadway, Paterson, N. J.

The following were elected as of date thirty days after publication of names:

Active

Carr, Parker H., Foreman, Reel Machines, Dyeing and Bleaching, Mount Hope Finishing Co., 206 South Walker St., Taunton, Mass.

Crowley, Kenneth, Y.M.C.A., Pawtucket, R. I. Colorist, Acme Finishing Co., Pawtucket, R. I.

Dodson, William C., 418 West Ave., Jenkintown, Pa. Salesman, Smith-Drum & Co., Allegheny Ave., Philadelphia, Pa.

Hargreaves, James, 217 Main St., Rockaway, N. J. Asst. Supt., Liondale Bleach, Dye & Print Works, Rockaway, N. J.

Hunt, Howard W., Box 452, Waynesboro, Va. Asst. Chemical Supt., Crompton Shenandoah Co., Waynesboro, Va.

Lauber, Theodore J., 232 Keen St., Paterson, N. J. Dyer, Kapo Silk Dyeing & Finishing Co., Inc., Morrisee Ave. & Henry St., Haledon, N. J.

Obermaier, Otto L., 235 Kenilworth Road, Ridgewood, N. J. Dyestuff Salesman, National Aniline & Chemical Co., Inc., 40 Rector St., New York, N. Y.

Okey, L. L., Hotel Patten, Chattanooga, Tenn. Salesman, National Oil Products Co., Chattanooga, Tenn.

Peterson, John, Box No. 1, Clearwater, S. C. Foreman Printer, Clearwater Mfg. Co., Clearwater, S. C.

Rouse, Richard, 16 Fairmount St., Nashua, N. H. Overseer, Nashua Mfg. Co., Nashua, N. H.

Schaffhauser, Harry, 276 East 24th St., Paterson, N. J. Boil-off Overseer, Lyons Piece Dye Works, 5th Ave. and Boulevard, Paterson, N. J.

Forty-six of the members dropped at the last Meeting for non-payment of dues were reinstated, having paid their dues since them.

A letter from the Howes Publishing Co., incorporating the Howes Publishing Co. understanding of an agreement between the Publishing Co. and our Association, and suggesting confirmation, was read. As this was not a very well represented Council Meeting, as many from the New York district were unable to be present, and at the written suggestion of Dr. Killheffer, this was laid on the table until the September meeting. In the meantime the Secretary shall send each member of the Council a copy of the letter for his study.

Notice of the Organization Meeting of the North Carolina State College Junior Section on June 6, 1930 from R. M. Mitchell, the Chairman of the Piedmont Section, who was authorized to form this section, was read and ordered placed on file.

A letter from Mr. E. Freedman, acknowledging receipt of prize check and expressing his appreciation, was read and ordered placed on file.

The meeting adjourned at about 3:45 P.M.

Respectfully submitted,

ALEX. MORRISON,
Secretary.

NORTHERN NEW ENGLAND SECTION OUTING

AFTER a week of rainy weather the sun broke through for a perfect score on Friday, June 13, when the Northern New England Section of the American Association of Textile Chemists and Colorists met at the Merrimack Valley Country Club again for its eighth annual outing, arranged by Frank McCool, John Grady, and Walter Zillessen. Seventy-one sat down to dinner following an afternoon of sports.

The President's golf trophy went to M. P. Graham for a low gross of eighty, and the Chairman's tennis trophy to C. H. A. Schmitt. Of the golfing visitors B. B. Fernald took the prize for low gross with an eighty-four, and Harry Metcalf won low net. Other prizes for golf went to J. W. Russell, members' low net, W. H. Butler, high gross, H. J. Sheehan, most sixes, and George Stewart, most sevens. W. L. Sjostrom and son took the doubles prize in tennis.

For next season Henry D. Grimes was elected Chairman; Harold C. Chapin, Secretary; John H. Grady, Treasurer; and Roland E. Derby and Clarence L. Nutting, members of Sectional Committee.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary.*

APPLICANTS FOR MEMBERSHIP

Active Membership

Boedecker, Ray W., chemist, Colgate Palmolive Peet Co., Palmolive Bldg., Chicago, Ill. Sponsors: C. W. Wille and E. W. Morgan.

Hargreaves, James, asst. supt., Liondale Bleach, Dye & Print Works, Rockaway, N. J. Sponsors: Percival Miller and Henry F. Herrmann.

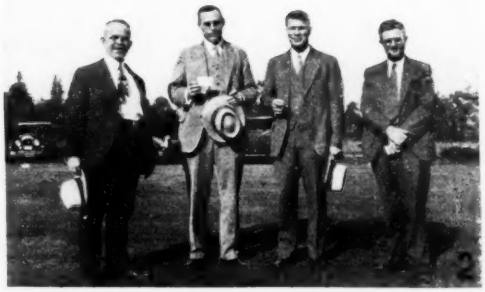
Hunt, Howard W., asst. chem. supt., Crompton Shenandoah Co., Waynesboro, Va. Sponsors: Ralph F. Culver and A. R. Thompson, Jr.

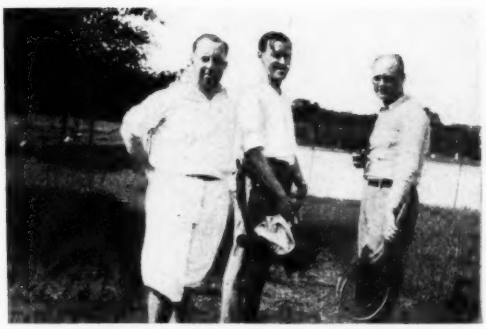
Lauber, Theodore J., dyer, Kapo Silk Dyeing and Fin. Co., Inc., Morrissee Ave. & Henry St., Haledon, N. J. Sponsors: Robert Patterson and Patrick Tomasulo.

Obermaier, Otto L., dyestuff salesman, National Aniline and Chem. Co., 40 Rector St., New York, N. Y. Sponsors: Robert H. Gaede and Frederick E. Otto.

Proceedings of the American Association of Textile Chemists and Colorists

Snapped at the Northern New England Section's Outing





1. *The man in front is Harry Davies.*
2. *Moran, Leitch, Whiteside and Nutting just looking prosperous.*
3. *Christison is cut out by Olney and Cady.*
4. *Frank McCool, Chairman of the Outing Committee.*
5. *The biggest smile belongs to Henry Grimes, Chairman-Elect of the Section.*
6. *Mr. Bannan at least looks like a tennis player.*
7. *Mr. Graham gets the President's cup for low gross in golf.*
8. *Someone must be getting tired.*
9. *John Grady thinks Bobby Jones is good, too.*

Schaffhauser, Harry, boil-off overseer, Lyons Piece Dye Works, 5th Ave. & Blvd., Paterson, N. J. Sponsors: Robert Patterson and T. Bernard Schneider.

Schanbacher, Karl L., chem. engineer, Victor Chemical Works, 220 E. 42nd St., New York, N. Y. Sponsors: James A. Branegan and S. G. Davenport.

ASSOCIATION BADGES

The lapel button badge illustrated herewith is worn by members of the American Association of Textile Chemists and Colorists.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

ALEX. MORRISON,
American Woolen Co.,
Andover, Mass.

A Study of Dye Adsorption

The Reactions of Dyes With Proteins, Carbohydrates, and Mordants

By **JOHN REHNER, JR., and ALLEN E. STEARN**

(Chemical Laboratory of the University of Missouri)

WHILE many speculations have been made as to the exact nature of the dyeing process, it is probably true that most of the confusion and indefiniteness regarding any theory which attempts to explain the fixation of coloring matter in an insoluble form is due to the vague meanings which have been attached to the term "adsorption". For this reason, if for no other, any attempt to propose a satisfactory explanation for certain dyeing phenomena must necessarily be accompanied by a rational interpretation of that term, and the failure to consider fully the important subject of adsorption injects into the theory of dyeing a strain of over-generality which, it seems, deprives the theory of clarity and allows the term adsorption to "constitute in most cases merely a more elusive term for stating an empirically observed fact".

Loeb and others[1] have presented evidence from which it may safely be concluded that stoichiometrical combination between proteins and various acids, bases, and dyes occurs. Stearn and Stearn[2] have presented significant data on the reaction between dyes and proteins which corroborate the above conclusions, and have also proposed a definite chemical mechanism for the reactions which they studied.

The prevailing opinion for many years has been that the dyeing of vegetable fibers is a purely physical phenomenon, implying a physical adsorption of the dye by the fiber. Examination of the literature shows almost complete agreement on this mechanical theory although Knecht[3] admitted that "a mechanical theory, as far as the dyeing of vegetable fibers is concerned, is not *a priori* out of the question". Justification for the mechanical theory is probably to be found in the chemistry of cellulose which, though it reacts (it is claimed) only with strong acids and bases, can nevertheless be dyed with quite a number of dyestuffs, the view therefore being that the union between the dye and the fiber is of physical nature.[4]

The fixation of dyes by mordants has been the subject of much debate. Years ago, Liechti[5] claimed that sodium alizarate and hydrous aluminum oxide form an aluminum alizarate. Biltz and Utescher[6] concluded that ferric oxide and alizarin form a ferric alizarate, but Williamson[7] and Bull and Adams[8] presented evidence to show that "adsorption complexes" and not definite chemical compounds were formed in these instances. It seems that much of this argument hinges on the meaning of "adsorption complex", and a consideration of this term will be made later.

In the present paper some data are offered giving fairly definite indication that in some processes chemical factors of an essentially simple kind are involved.

Experimental

Basic dye ions were found[2] to cause an increase in H-ion concentration when added to solutions of typical proteins, although both solutions originally possessed the same pH value. Acid dyes gave an analogous effect in the opposite direction; that is, the H-ion concentration decreased. It was found that the only adequate explanation was on the basis of a definite reaction between the dye ions and the oppositely charged protein ions. The following chemical mechanism was proposed:

$$HPr \rightleftarrows H^+ + Pr^- \qquad (1)$$

$$Pr^- + D^+ \longrightarrow DPr \qquad (2)$$

Thus, the removal of protein anions by the dye cathion to form unionized dye proteinate shifts the equilibrium of equation (1) to the right with a resulting increase in H-ion concentration. Analogously, for acid dyes::

$$PrOH \rightleftarrows Pr^+ + OH^- \qquad (3)$$

$$Pr^+ + D^- \longrightarrow DPr \qquad (4)$$

It was found that these pH changes could not be attributed to the hydrolysis of the dye with subsequent adsorption by the proteins, for the change in H-ion concentration was found to be greater at *lower* pH values than at higher ones, and furthermore, the magnitudes of the changes were the same when the proteins were in solution as when they were present in the solid phase. Conductivity studies[9] have further confirmed the mechanisms given above.

The authors have extended this method of investigation into a study of the reactions of dyes with not only proteins but also some carbohydrates and mordants, and have found that a simple, metathetical theory would explain and often predict many of the results obtained. The procedure employed was quite simple. Solutions or suspensions of the substances investigated were adjusted to the same pH, and the pH after the solutions were mixed was determined by measuring the potential of a quinhydrone electrode against a saturated calomel electrode. The dyes used were Grübler products except the methylene blue and pararosaniline base, which were from the National Aniline and Chemical Company. The spinach, potato, and tomato proteins were prepared by Dr. Gordon Alles at the California Institute of Technology, and the egg albumen by the Will Corporation. All other reagents were of Baker, C. P. quality. The dye solutions contained three grams per liter, except the crystal violet which contained 1.5 grams. The other solutions were 1 per cent, unless stated otherwise.

Table I contains data representative of the experiments with proteins and dyes both in magnitude and direction of pH change.

TABLE I

NUCLEIC ACID WITH BASIC AND ACID DYES

	Crystal Violet			Eosin		
	pH	$-\Delta$ pH	$\Delta(H^+)$	pH	$-\Delta$ pH	$\Delta(H^+)$
1. Dye	3.90			3.97		
2. Acid	3.84			3.97		
3. Mixture	3.42	0.42	1.4×10^{-4}	3.96	0.01	——
1. Dye	4.90			4.65		
2. Acid	4.60			4.66		
3. Mixture	4.24	0.36	3.3×10^{-5}	4.66	——	——
1. Dye	5.70			5.54		
2. Acid	5.62			5.56		
3. Mixture	5.25	0.37	3.2×10^{-6}	5.56	——	——
1. Dye	7.05					
2. Acid	7.08					
3. Mixture	6.96	0.13	3.0×10^{-8}			

Here it is seen that the strongly acidic nucleic acid shows reaction *only* with basic dye ion. In the above outlined mechanism, the conditions were so chosen that basic dye ion was added to un-ionized protein, H-ion being displaced from the latter to give a pH decrease. If, now, the same types of substance be used but under conditions where protein anion is added to un-ionized dye base, the same fundamental reaction between dye and protein should now result in the liberation of OH-ion from the dye base. Thus:

$$DOH \rightleftarrows D^+ + OH^- \qquad (5)$$

$$Pr^- + D^+ \longrightarrow DPr \qquad (6)$$

Spinach, potato, and tomato proteins having an isoelectric pH of about 4 and pararosaniline base were used. The pH which 0.1 gram of the dye base estblished in 50 cc. of water was found to be 7.81. Saturated solutions of the proteins were prepared, and to 50 cc. portions adjusted to this pH, 0.1 gram of dye base was added and the change in pH determined after equilibrium was attained. The results substantiate the prediction made on the basis of equations (5) and (6).

Furthermore, protein cathion should liberate H-ion from free un-ionized acid dyes giving decrease in pH in place of the increase found when free dye anion reacts with un-ionized protein. Tetrabromfluorescein, prepared by precipitation of eosin with hydrochloric acid, and a by precipitation of eosin with hydrochloric acid, and a used at a pH of 4.24. A pH decrease of 0.29 was obtained. Since the isoelectric pH of haemoglobin is about 7, the protein in this experiment was largely ionized and, on the basis of a metathetical reaction, combined with the anions of the slightly ionized dye acid to liberate H-ions. The above data are in agreement with this view.

Data which were in agreement with the theory were obtained in experiments employing albumen with eosin, congo red, methyl violet, and methylene blue.

Sufficient experimental data have been collected to allow the following conclusion. Their applicability obviously depends on the H-ion concentration, the isoelectric point of the protein, and the nature of the dye substance (i.e., whether it is used as the salt, free dye acid, or dye base), eight simple types of mechanism can be proposed to account for, and predict, the pH changes which occur with protein-dye systems. These types are tabulated in a summary fashion in Table 2.

TABLE II

REACTION MECHANISMS FOR PROTEIN DYE SYSTEMS

Type	ΔpH
1. $D^+ + HPr \rightarrow H^+$	—
2. $D^- + PrOH \rightarrow OH^-$	+
3. $Pr^+ + D^+ \rightarrow$ no reaction	small effect, if any
4. $Pr^- + D^- \rightarrow$ no reaction	small effect, if any
5. $Pr^+ + DOH \rightarrow$ no reaction	no effect
6. $Pr^+ + HD \rightarrow H^+$	—
7. $Pr^- + DOH \rightarrow OH^-$	+
8. $Pr^- + HD \rightarrow$ no reaction	no effect

On the assumption that the magnitude of pH change is a rough measure of the reactivity of the substances investigated, some results obtained with carbohydrates bore considerable interest. Above a pH of 5, soluble starch and dextrose with basic dyes behaved in accordance with the following mechanism:

$$H\,Carb \rightleftarrows H^+ + Carb^- \qquad (7)$$

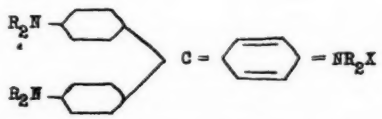
$$D^+ + Carb^- \longrightarrow D\,Carb \qquad (8)$$

Anomalous results were obtained with acid dyes, although it seems significant that in all cases pH changes were obtained comparable in magnitude to those obtained with proteins. Cotton cloth and filter paper with basic dyes yielded data in conformity with equations (7) and (8).

That the pH changes observed in the dye-carbohydrate systems are probably not due to the ash constituents of the latter was ascertained by studying the action of basic and acid dyes on N/100 solutions of alkali and alkaline earth chlorides, nitrates, and sulphates. In no instance

was a pH change of more than 0.02 obtained, the insignificant changes recorded being almost unmistakably attributable to experimental error, or to the fact that the solutions were unbuffered. These data are interesting in view of the fact that Michaelis and Rona[10] maintain that technical forms of cellulose such as cotton and paper take up dyes by virtue of ion exchange with the ash constituents of the cellulose, claiming that the cellulose, if it reacts at all with the dye, does so to only "an extremely minute extent". Since the salt impurities in the absence of cellulose do not give pH changes, it seems that their claim may be questioned, for it is an expression of what appears to be a quite exaggerated opinion of the chemical inactivity of cellulose. Judging from the experimental data on cellulose-dye systems herein presented, it would be unreasonable to persist in the belief that the dyeing of vegetable fibers is necessarily a physical process. Chemical reaction, signifying compound formation, is undoubtedly a surface reaction in most of the cases studied in which the solid phase was present, and because of the continually changing surface area of the latter, inability to obtain identical total analyses would not disprove stoichiometrical combination and definite compound foundation.

In regard to the apparently anomalous results obtained with dyes on filter paper and cotton, some data have been presented[9] which indicate "that as the H-ion concentration increases. the non-quinoid amino groups in a compound such as



which represents the general structure of most of the basic triphenylmethane dyes, begin to function as salt formers". Thus, the amino groups may take up H-ion by mass action and the binding of the amino-salt by the cellulose may make other groups more active.

Table 3 is a sample of data obtained with chromium hydroxide and acid and basic dyes.

TABLE III

Dyes With Chromium Hydroxide

	pH	Δ pH	$-\Delta(H^+)$
1. Alizarin red S	6.90		
2. Chromium hydroxide	6.90		
3. Mixture	7.00	0.10	2.6×10^{-8}
1. Alizarin red S	5.98		
2. Chromium hydroxide	5.92		
3. Mixture	5.95	0.03	8.0×10^{-8}
1. Alizarin red S	3.80		
2. Chromium hydroxide	3.80		
3. Mixture	3.86	0.06	2.0×10^{-5}
1. Eosin	6.90		
2. Chromium hydroxide	6.90		
3. Mixture	7.20	0.30	6.3×10^{-8}
1. Congo red	6.90		
2. Chromium hydroxide	6.90		
3. Mixture	6.99	0.09	2.4×10^{-8}
1. Methyl violet	6.90		
2. Chromium hydroxide	6.90		
3. Mixture	6.96	0.06	1.6×10^{-8}
1. Methylene blue	6.90		
2. Chromium hydroxide	6.90		
3. Mixture	7.01	0.11	2.8×10^{-8}

The behavior of this mordant with acid dyes could be explained on the basis of a mechanism similar to the following:

$$Cr(OH)_3 \rightleftarrows Cr^{+++} + 3OH^- \qquad (9)$$

$$Cr^{+++} + 3D^- \longrightarrow D_3Cr \qquad (10)$$

although this kind of explanation fails in the case of basic dyes. Data which could not be satisfactorily explained on the basis of a simple mechanism like the above were obtained with aluminum hydroxide, although the pH changes observed with the latter mordant were greater than those of Table 3.

Burns and Wood[11] found that with increasing pH, decreasing amounts of acid dye were "adsorbed" by hydrated chromic oxide. The authors prefer to believe that with increasing pH, decreasing amounts of acid dye *react* with the chromic oxide. As the pH increases, the ampholytic chromium hydroxide becomes more acidic in its properties. On the basis of a mechanism such as given above, we would therefore predict a minimum amount of reaction at these higher values. At low pH values, we expect the basic properties of the ampholyte to be especially predominant, and therefore predict a maximum amount of reaction with an acid dye. These predictions are substantiated both by the experimental data presented here and by the work of Burns and Wood and by Reinmuth and Gordon[12] (for alumina). These investigators prefer to designate the phenomenon as "adsorption" rather than reaction, although Adamson and Wood[11] concede a tendency to compound formation in several cases where chromic oxide was used.

Discussion

Alternative explanations of the observed pH changes are few in number and seem after consideration to be less satisfactory.

The generality of the phenomenon of pH change and the fact that these changes in ampholytes by the addition of acid and basic dyes at corresponding pH values, though in opposite directions, are of similar orders of magnitude seem to preclude the possibility that the activity coefficients in the original solutions are different in the mixture, the result being that the H-ion concentrations before and after mixing are the same although the potentiometrically determined activities are different. It is difficult to conceive of any hypothesis which should attribute to these two types of dyes the selective power of raising on the one hand and lowering on the other the activity coefficient of the H-ion in the experiments performed.

An attempt to explain the pH changes on the basis of hydrolytic adsorption has, for many of the proteins, been shown[9] to be without foundation. Conductivity studies of the carbohydrate-dye and mordant-dye systems will be made in order to establish more firmly the theory of replacement reactions as applied to the latter systems. Reinmuth and Gordon[13] have recently shown that hydrous aluminum oxide and Orange II react to form a definite compound, proving that "if adsorption is assumed, it is necessary to assume adsorption of equivalents—which dif-

fers from compound formation only in nomenclature". Their research seems to indicate a decided probability of compound formation in other mordant-dye systems.

It is difficult to avoid the conclusion that the changes in H-ion concentration obtained in these experiments are indicative of chemical reaction, even though the postulation of definite chemical mechanisms is not always possible. In view of the fact that the term "adsorption", because of its indefiniteness, generally tells us little of what may actually be occurring, the explanation on a basis of chemical reaction of many experimental results heretofore regarded as cases of adsorption phenomena, while it may not always be correct, seems highly preferable.

SUMMARY

1. Various basic and acid dyes produce changes in H-ion concentration when added to solutions or suspensions of proteins, although the solutions originally possessed the same pH value. The only satisfactory explanation found for these results is that the dyes and proteins undergo definite chemical reactions. Chemical mechanisms have been proposed which predict and account for the observed results.
2. Similar changes in H-ion concentration are obtained with dyes and certain carbohydrates such as soluble starch, dextrose, filter paper, and cotton. The tendency to minimize the reactivity of carbohydrates has been criticized.
3. Suspensions of aluminum and chromium hydroxides and various basic and acid dyes behave in a manner similar to that of the behavior of protein-dye and carbohydrate-dye systems. Experimental evidence is in favor of compound formation between these dyes and aluminum and chromium hydroxide mordants.

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Recent Literature

"The Finishing of Woven Fabrics" *Technical Factors and Principles by Eber Midgley, F.T.I., Professor of Textile Industries, Technical College, Bradford. Published by Longmans, Green & Co., 208 Pages. Cost* $7.00.

Owing to the highly specialized nature of the textile industry, there has been a decided tendency for each branch to concentrate upon its own concerns, and pay but little attention to the workings of its allied sections. It is a fact, however, that the specialist in any one branch could handle his own work far more intelligently if he should acquire some knowledge o f the fundamentals, at least in other departments. This is particularly true of preliminary processes upon which the success of his own work may largely depend, or subsequent processes which may depend very largely for their satisfactory completion upon work in which it may have already had a part.

The volume under consideration takes up the entire subject of finishing of woven fabrics, whether they be of cotton or of wool, and describes the numerous individual processes which, taken as a whole, result in the production of a marketable fabric.

To the finisher who wishes to extend his knowledge of the subject beyond the boundary of his own particular line, and also the textile manufacturer, in general, and to the textile chemist and dyer, who wish to become better acquainted with the allied subject of textile finishing, this book can be highly recommended. It is excellently illustrated with twenty-nine photomicrographic plates, and, in addition, sixty-five illustrated figures and charts. The book makes no pretense of being an exhaustive treatise on finishing, but as stated by the author, is an attempt to demonstrate the underlying principles of the chief factors involved in cloth finishing.

It is divided into five rather distinctive parts:

Part I—A general discussion of processes preliminary to finishing, the constituents of woven fabrics and cloth structure.

Part II—Finishing of wool fabrics.

Part III—Finishing of union fabrics.

Part IV—Mercerizing and Schreinering cotton goods.

Part V—Influence of dyeing and finishing on woven fabrics.

The book is systematically arranged and should

give the reader a comparatively good knowledge of the subject in the shortest possible time.

L. A. O.

"How to Clean Rugs and Upholstery Fabrics"

C. C. Hubbard. Formerly and for many years Director of Education for the National Association of Dyers and Cleaners. 386 Pages, 38 illustrations, 3 tables, published by the Rug Cleaners Institute, 225 West 34th Street, New York City. 1930. $7.50.

This is the first authoritative book devoted entirely to the subject of rug and upholstery cleaning. In its production the author has worked under the supervision of the officers of the Rug Cleaners Institute, and the technical instruction given and the methods of treatment described are approved by them.

The usefulness of this volume is greatly enhanced by its completeness, covering as it does a wide range of subjects of interest not only to rug cleaners, but to workmen in rug manufacturing plants and to those interested in their distribution and sale.

The book is fundamental in character, as it discusses the different fibers used in the manufacture of all types of rugs, and the serviceability of those fibers. The different types of oriental rugs are classified and more or less information given as to their identification. A large proportion of the book is devoted to the methods and processes of cleaning carpets, rugs and upholstery materials. The methods of procedure are described with sufficient detail to permit of their being carried out in a practical way by anyone who is at all familiar with this type of work. Furthermore, the theory and scientific principles involved in these processes is not overlooked and the matter of soaps, various other detergents and chemicals used are discussed from the point of view of their relative value and chemical properties.

Mr. Hubbard has also gone extensively into the subject of removal of stains from different sources and given numerous formulas for this purpose. Methods of testing for color fastness to the various processes such for instance as the so-called shampooing of rugs, have been described, also methods for insect control during storage.

Every effort has been made by Mr. Hubbard to bring together all of the information upon this subject which is reliable and usable. The book is well illustrated with diagrams, cuts of machinery and tables of technical information. It has an excellent index which makes it convenient for ready reference. While the book is fundamentally for the benefit of the membership of the Rug Cleaners Institute, it may be purchased by any interested person.

L. A. O.

A Dictionary of Color. *A. Maerz, Director, American Color Research Laboratory, and M. Rea Paul, Consulting Colorist, Research Laboratories, National Lead Company. McGraw-Hill Book Company, Inc., 370 Seventh Avenue, New York City.* 1930. *pages* 207, 9½ x 13, *Colored Plates* 56. *Price* $12.00.

This book is outstanding in three respects. First; It contains in a convenient form more than 7,000 actual color reproductions in a permanent form. Second; The authors have compiled an alphabetical index of practically all color names that have been published up to the present time in the English language, exhausting every available source. Third; After several years of painstaking and careful work, they have (as far as has been possible) assigned each name to its proper place in the extensive color charts in such a way that it may be instantly located. In addition there is an introductory discussion of color terminology and color matching, and comparing, which not only makes the book readily workable but at the same time gives a very lucid treatment of the whole subject in general. The authors have also included a very complete bibliography of all books using color names, a history of color standardization, and in addition to indexing more than 3,000 color names, have discussed several hundred of them with considerable detail.

It is definitely stated in the preface that no attempt has been made to introduce any new type of color system, or to coin any new color names.

Where 144 different shades of one color are printed upon the same page some difficulty may be experienced in detecting the slight differences between them and quickly matching an outside color with the proper one on the page. This we believe could have been greatly facilitated if several neutral gray screen or shield cards had accompanied the book. This, however, is not a serious difficulty since one may easily make screens of a heavy neutral gray paper to suit his own requirements.

This book will be a valuable aid not only to those who are constantly required to reproduce colors having specific names but also in the selection and matching of colors for many purposes.

L. A. O.

New Species of Patents Sought for Machinery

By Waldon Fawcett

COINCIDENT with the approval, by one branch of Congress, of the long-pending program of Design Registration, there has been inaugurated in responsible quarters a movement to institute yet another form of protection for industrial property. The latest proposal contemplates the establishment, within the nation's patent system, of a special technical classification devoted to machines and machine parts.

This move, which is significant for producers and users of dyeing, bleaching and finishing machinery, is not, as might be supposed, a by-product or off-shot of the design copyright project which has lately come half-way to realization. Rather, is the new venture inspired by a special and particular form of dissatisfaction which has rankled for some time with respect to the operations of the existing Design Patent law.

To many persons in the textile industries and associate lines, the Design Patent law has been unsatisfactory because it has given, as though grudgingly, a protection

that is expensive, cumbersome, and dangerously tardy in operation. With the machinery manufacturers, the insistence upon "invention" has been overshadowed by an official prejudice against all devices on machines with moving or moveable parts.

Naturally, this disqualification is not a stipulation within the law but is born of the regulations formulated at the Patent Office, or the administrative policies evolved by the Patent executives. Popularly expressed, their logic, as repeatedly applied, has been that inasmuch as a design patent is based on the appearance of the object patented, there cannot consistently be a patent grant for a specific design when the appearance of the subject matter is changeable owing to the operation of moving parts. The Patent Office heads have found it difficult, apparently, to accept the idea that a given mechanism should command both a mechanical patent and a design patent.

As luck had it an official resolution, as of date of 1930, has, seemingly, made all but unnecessary the agitation for a new annex to patent law. In a test case, involving a mixing machine, the U. S. Court of Customs and Patent Appeals,—a tribunal lately created by Congress specifically to review the rulings of the Patent Office—has, in effect, served notice upon the Commissioner of Patents that patents for design must, under appropriate circumstances, be granted for machines embodying moving parts. Despite this signal victory for the cause of ornamental design in machinery, the movement for special recognition continues. Perhaps, because it had taken form ere the Appeals Court came to the rescue, and because the Court was divided in its recent decision.

Mr. John F. Robb, a patent specialist of Cleveland, is leading the movement for patent relief. Asked to outline, for the American Dyestuff Reporter, the proposal for a new law of patents for original machine and article-of-machine designs, he said:—

"The practice of the Patent Office has been of a most erratic nature in administering the law, known as the design patent statute, by which new and ornamental designs are protected in behalf of the inventors and owners thereof. About thirty years ago, the common occurrence was for patents to be granted for the design of almost any structure or article of manufacture, the patentability of which was not evident or non-existent under the general patent statutes for mechanical inventions. The time is recalled when a design patent was always advised when a mechanical patent was deemed unobtainable.

"But there came from the courts decisions affecting designs for a horse-shoe calk, and a plow-share, and similar wholly utilitarian inventions as to which a contention of ornamentality was absurd. These decisions, together with clarifying amendment of the law, properly put a quietus on issuing ornamental design patents for designs having no appeal whatever to the aesthetic or artistic, and in no way ornamental. Since that time the Patent Office has more or less construed the law with strictness, a little loosely under one commissioner, more rigidly under another. Of late years much has been left to be desired in interpreting the law as it applies to designs for machines.

"Inconsistent decisions of the Patent Office and divided decisions by the Federal courts lead to the belief that a new kind of law might be in order, as much as one hesitates to suggest such a thing. Manufacturers throughout the country are, time and again, developing original, individual and new designs for machines, structures and articles of manufacture. That such may not be ornamental is no reason why, if they are new and original, they should not be protected. The individuality that a creator of a machine incorporates therein may or may not be of an ornamental nature, and yet it may involve originality and invention of as high, or higher degree, than ornamentality requires. Why should such a creator be discriminated against?

"It is urged that a law shall be passed to grant to those who create new and original designs of the class discussed, a seventeen year monopoly just as is afforded under the so-called general patent law. This kind of a law is believed to have been found useful in Germany. Many of us have always taken the view that machines may involve the very highest design skill to present both structure and appearance. Many persons are stationed before a machine for a longer period each day than the waking hours spent in their homes and if they enjoy beauty in their homes why is it not a natural instinct to be appreciative of harmony and pleasing appearance in the machine?"

The question has been raised as to the predicaments that might ensue, if, with a new machine patent law similar to the existing copyright law, it fell out that two or more manufacturers applied for protection on original designs of machines, substantially similar. Advocates of the proposed legislation insist that there can be no serious difficulties on this score. In proof, they point out that under the workings of the U. S. copyright system it is rare, if not unheard of, for a subsequent applicant to offer as an original creation the subject matter of a book already copyrighted by an original author. Champions of the proposed supplementary law scout the idea that it would involve any departure or concession from the basic standards or underlying ideals of the U. S. patent system. They insist that the originality involved in the average machine design, which would be eligible to the new classification, constitutes as much or more "invention" than is to be found in many mechanical patents issued in current routine.

Calco-Heller & Merz Boston Offices

Calco Chemical Company have announced that they recently completed a consolidation of the Boston offcies of Heller & Merz Corporation and themselves. To that end they have leased the entire building at 35 Hartford Street where extensive stocks and laboratory facilities to serve the New England trade will be maintained. Heller & Merz will continue as a separate corporation supplying the paper trade and Calco will sell to the textile and other trades.

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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Published biweekly by
HOWES PUBLISHING CO., INC.
440 Fourth Avenue, New York City

A. P. HOWES, President

Subscription price $5.00 per year; Canadian $5.50; foreign $6.00

Vol. XIX July 21, 1930 No. 12

A CONTINUING CONTROVERSY

PERIODICALLY discussion arises as to the advisability of putting the metric system in general use in this country. The advocates of change claim that the system of feet and pounds suffers much by comparison. The metric system is now followed by every civilized country in the world except Great Britain and the United States, and even in these two countries it is employed in all scientific work and by many new industries.

One objection to the metric system is that abandonment of our present system would put many calculators out of work. This would be true, at least for a time, but their services, it is asserted, could be used in a more constructive manner. Also it is urged by those opposed to the change that, should the United States adopt the metric system, the result would be that the two English-speaking countries of the world would have different standards of weights and measures. This situation would, of course, be one for ultimate adjustment. A more practical objection than any of the foregoing would relate to the necessary changes in machinery with all the attendant expense.

It is of interest to recall that it was only because of a mistaken impression concerning the early success of the metric system that Great Britain is not using it at the present time. In 1906, the metric system was declared obligatory in England. However, this obligation failed to be applied due to the fact that on March 22, 1907, in the House of Commons, Lloyd George declared (as a result of misinformation) that the "metric system has broken down hopelessly in France." This statement was largely responsible for the rejection of the system in England.

In passing, it is to be recalled that our monetary system is based on decimals. Why then do we not accept a system of weights and measures which is equally simple and operates on the same principle?

It may be significant to note a few of the uses of the metric system in this country today. The wave length of radio is measured in meters, coins are weighed by the metric system, yachts are classed according to their length in meters, all motion picture film is made exactly 3.5 centimeters wide, and even food is classified according to the metric system when calories are used to designate the heat value.

Metric system advocates point out that, if through some catastrophe the standard yard as recorded by the Bureau of Standards as the model unit of measurement were destroyed, it could not be replaced without some question as regards its accuracy. Supposing on the other hand that the standard meter were destroyed. It could easily be replaced, for the meter tangibly represented by this standard is defined in terms of measurement that are not subject to change. The rays from heated cadmium are more immutable than the universe and they fix forever the length of the world's meter.

THE OPEN MIND

OF COURSE, everyone knows the employer who will not listen to suggestions from men under him. He brings to mind the story that is told of Napoleon. When the French Emperor was encamped with his forces at Boulogne on the shores of the Channel awaiting a favorable wind to carry his army to England, an orderly approached him with a message. The great general had been waiting days. He was in no mood for an interview. "I am busy! Why bother me with your schemes and inventions?" he snapped, and soon the visitor was dismissed. That man was Robert Fulton, the inventor of the steamboat, who could have suggested transportation regardless of the weather.

This anecdote has many parallels in the business and industrial worlds of today. Often an employee tries to offer suggestions as to how a thing might be better done in his department. What happens? The employer is too busy to listen—too busy, oftentimes, with the same problem that his subordinate may have solved.

Surely it pays to have a mind open to suggestions, even though they may come from unexpected sources. It is human nature for a man doing a certain job to try to simplify it. Sometimes he is successful—perhaps more often not. However, as he is in more intimate contact with his particular task, it always is possible that he may have some helpful hints to suggest. It has often been said that a wise man is one who can learn from one who is not thought to be wise.

HAVING THE OFFICE AS AN ASSET

IF THE executive would study his office production and its costs as closely as he scrutinizes those of his factory, he probably would find that his time had been profitably spent. All too often the chief looks upon the office as a necessary evil, and confines his activities largely to manufacturing and selling problems.

If a man feels that his office is not running quite as efficiently as he thinks it should, he might start his reorganization by examining his own routine. For example, does he have to wait for the stenographer, or perhaps does his stenographer have to wait for him while he attends to telephone calls and other interruptions? When a department head wishes to speak to a subordinate, does the subordinate have to be sent for, or is an interdepartmental telephone used? Can information be given immediately to a customer when he calls on the telephone, or must he wait for a return call after the matter has been looked up?

All offices cannot be made over to modern methods at once. But in most instances there can be a consistent approach to modern standards. Certainly the head of an establishment should be able to obtain correct, up-to-date information about the standing of his business at any time. He should be relieved as much as possible from routine duties and thus given required opportunity for constructive thinking and acting. By systematizing work, and by employing labor and time-saving devices, insofar as it may be advisable and justified, an office staff can give service such as no harassed and overworked group ever is able to render.

Random Thoughts On Research

(In Summary)

WE have, in this little series, perhaps said some rather heretical things, but will not the thinking person raise the same questions sooner or later? Let us then recognize them and be ready with answers. Arguments may be useful, but *reasons* are wanted.

Lack of prosperity in the textile business does not necessarily prove the need of research. There are too many other causes, but it is reasonable to suppose that research will help rebuild a new prosperity.

The average textile chemist's problem is how to do, or help to do some specific thing in a mill and to get credit for it. Almost any chemist or other technical man in a mill organization would like to see his company support research.

Why? Because the results of fundamental research will make his job easier and the appreciation of scientific men will make his job better. A research program should open new opportunities outside of the program itself. L. G. Lowrie brings out this point in the Applied Chemistry Reports (British) for 1928.

"There appears to be no doubt that the importance of organized chemical and physical research is receiving each year a wider recognition. . . At the same time, there are far too many firms who are unable to take advantage of published results owing to their lack of an adequately trained personnel. Such firms must, in the long run, fall behind their more scientifically trained competitors."

Talking about research brings peculiar reactions. One mill manager is known who talks beautifully in meetings about research in the abstract, but when he had an unusual opportunity to use research service he was very half-hearted about it, or he did not know how to take advantage of it. One is led to wonder how many who are willing to be quoted in a rather general approval of research, are really interested, and know what they are talking about.

The idea of a service laboratory seems to have been dropped. We all know that only an association of some sort can set up test standards and get them used. The writer has yet to hear a real good objection to the A.A. T.C.C. taking up such a project. There is certainly no more practical way to develop and introduce standards than to use them on practical work and to be ready to referee any cases where their use seems for any reason to have been unsatisfactory. The establishment of such a laboratory with a clearly defined field in testing would probably do more to popularize testing and to increase the amount of such work to be done, than it would to take it away from consultants and commercial laboratories. People once thought that the new power looms, and spinning and knitting machinery would cause dire calamities but they have proved to be for the good of all concerned.

The field of research of such a laboratory would be such that it would compete commercially with nobody.

Before fundamental research is ever established here we shall have to get down to earth and consider many specific problems, some of which we have not even thought of.

The two general fields of research must be kept in mind, that which helps the individual firm exclusively and is largely its own lookout, and that which is useful to all in the trade who are willing to profit by it.

The Shirley Institute of the British Cotton Industry Research Association has cost much more than $2,000,000. Its subscribers do not rake in dividends and must do most of their own thinking in order to profit by it. Still, it is considered successful.

A non-textile consulting engineer in the industrial field told the writer that the sponsoring of a real research program would undoubtedly greatly increase the values of the securities of the textile firms behind it.

A keen textile manager no doubt reflected a general view in the industry when he stated that the only way in which research could be carried on in a large way would be to get some of the bigger *business men* interested. Others would, no doubt, follow a few such leaders.

The mill laboratory itself was an experiment only a few years ago. It is now considered essential by many large textile corporations. A general research program will appeal to many mill men as an experiment, and an expensive one at that. We have the problem of demonstrating that it, too, is bound to be successful.

Mildew in Textile Mills, II

By **HERBERT C. ROBERTS**

Manager Textile Sales, E. F. Houghton Co.

(EDITOR'S NOTE). *The illustrations below were received too late to accompany the first part of Mr. Roberts' article appearing in the last issue of the AMERICAN DYESTUFF REPORTER and are reproduced herewith in the belief that they add much of value and interest to the subject.*

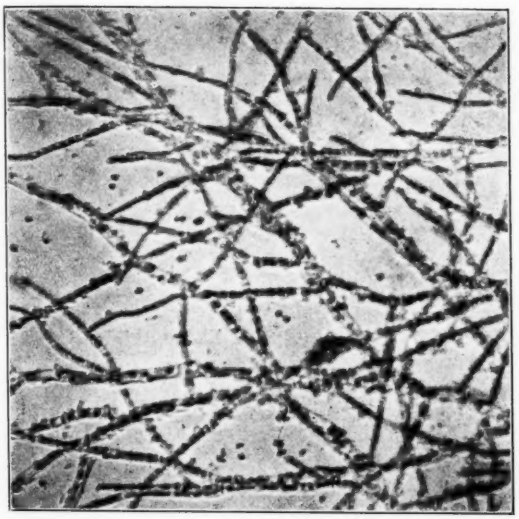


Fig. 1. A typical colony of mildew spores (300x)

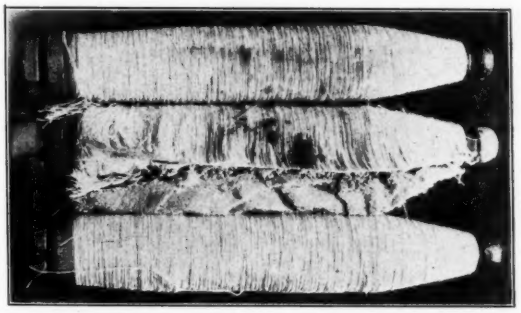


Fig. 3. Mildew in cotton prines. This yarn was wet-twisted, and after twisting stored without access to air. Note that the mildew is all on the surface.

Fig. 4. Mildew in a linen napkin. The finished goods were stored in a damp warehouse.

Fig. 2. Mildew on this silk cone developed over-night when the silk was placed in the humidifying closet.

Fig. 5. Mildew on silk douppions. This bale of silk fell into the water while being loaded on a boat, and before the silk could be dried out it had mildewed along the tie strings.

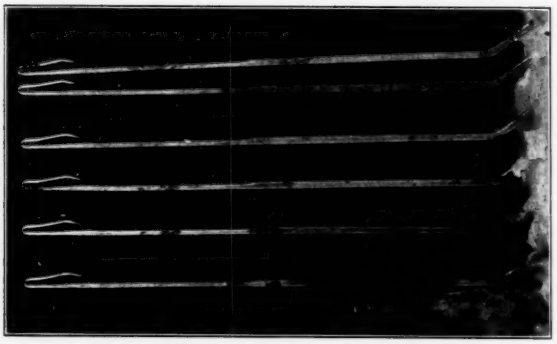


Fig. 6. Action of a mildew preventative on knitting needles. Note how it has rusted and corroded the steel.

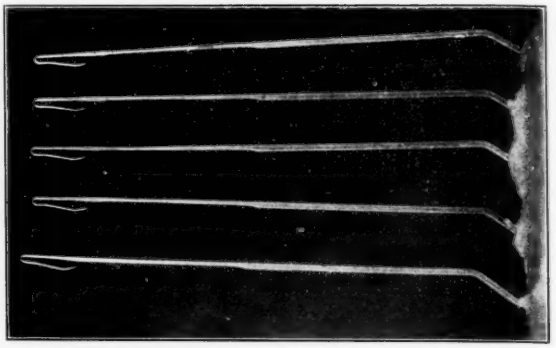
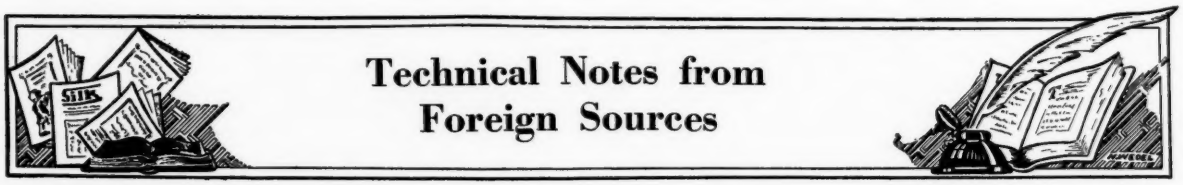


Fig. 7. A correct mildew preventative has no action on any of the parts of the machinery used.



Copper-Oxide-Ammonia, Its Preparation, Evaluation and Use in Textile-Microscopic Investigations

A. P. Sakostschikoff—Mell. Textil-Ber. 10,947 (1929). —A fine paper from the Dye Laboratory of the Polytechnic Institute of Nowotscherkassk, Russia. All these items of the title are described and discussed, and the text is illustrated with 18 reproductions of photo-micrographs of various fibers differently treated with the reagent.

The reagent itself, commonly known as Schweitzer's reagent, is of course a "solution" of copper oxide in ammonia water, though chemically this description is rather one of the method of formation than of the true constitution of the substance, a matter which is very doubtful. One standard method of preparation consists in precipitating copper sulphate solution with caustic soda solution, filtering, washing the precipitate well with water, and dissolving it in 20% ammonia-water. A better method, much used, consists in precipitating a reasonably strong solution of copper sulphate with very dilute ammonia-water, letting the bluish-white precipitate settle, washing it well by decantation, filtering upon a cloth filter, and draining as dry as possible with suction, the precipitate being finally dried at about 100°C. in a drying-closet. The greenish powder so obtained is preserved in well-closed bottles. To prepare the reagent, this solid is shaken up with a little ammonia-water till the liquid is saturated, followed by filtration. This method, however, is inconvenient, for proper washing of the precipitate is very tedious but necessary, and the reagent prepared from it does not keep well. A method, which was discovered in use by the author in the laboratory of a Russian mill, consists in the passing of pure (i. e., CO_2 free) air through a mixture of ammonia-water and copper in the form of wire or foil. A figure of the apparatus is given, but is hardly necessary. The air, drawn through by a common suction-pump at the end of the train, is passed through two wash-bottles containing caustic soda solution, and from these to the bottom of the flask which contains the copper covered with a layer of ammonia-water. From these, the air-current passes through a safety-bottle, containing water, to the pump. In the presence of ammonia, the oxygen of the air oxidizes the copper readily, and the layer of oxide formed is immediately dissolved by the ammonia-water. (Probably more than one chemist can remember employing the same method in his younger days, with ammonia-water procured from the bottle on the pantry shelf, and the copper wire abstracted from the door-bell system, without much benefit to the latter. One was directed, in the procedure thus followed, in the days before artificial fibers were much thought of, to cut the wire into such lengths that the pieces would stand partly out of the ammonia-water in the bottle, and to shake frequently. The method worked well, too). The author states that with a reasonably good air-current half an hour is enough to prepare a sufficiently concentrated, fully clear reagent, ready for use, and that the reagent keeps rather well under ordinary precautions. When the reagent is ready, the liquid is poured off for use, the flask and copper washed a few times, and the flask filled with water, and left thus until the reagent has to be prepared again.

As to the strength of the reagent, the author points out that the directions met with in the literature demand,

e. g., "freshly-prepared reagent," or "the reagent must be prepared at as great a concentration as possible," etc. Tests made in the supposition that the reagent is all that it should be (i. e., with the reagent as it is frequently prepared) are often disappointing; either the fiber does not dissolve, or else it dissolves so rapidly that the phenomena expected during the test escapes the observer's attention. This is particularly the case in the examination of bast-fibers. This is all due, of course, to the variation in per cent. of copper in the reagent; and it is to be regretted that in the otherwise valuable procedures of the literature no figures are given for this per cent. of copper, in the reagent appropriate for the test in question. The author has worked out this point carefully, using reagent which was prepared according to the method described by him, of "airing" the ammonia-metallic-copper mixture, using a 25% ammonia-water. The copper exists only in the "Schweitzer compound," the ammonia partly in the same compound, and partly as free ammonia. The values of the reagent were determined by titrating the Cu with KCN solution according to Low, as follows:

The KCN solution is first standardized. About 20 g. of the purest KCN obtainable is dissolved in 1,000 cc. of water. In a 200 cc. Erlenmeyer flask, 0.2 g. of copper is dissolved in 5 cc. of concentrated nitric acid, to this solution is added 25 cc. of water and 5 cc. of bromine water, the mixture being then boiled to expel free bromine. Then are added 50 cc. of water and 10 cc. of ammonia-water, of sp. gr. 0.9, the mixture is cooled to room temperature under running water, and the solution of KCN gradually run in with good shaking to the point of formation of the light bluish-white coloration. So much water is then added that the total volume amounts to 150 cc., and the KCN solution is then run in further to the point of complete decolorization. The weight of the copper divided into the number cc. of KCN of solution used gives the KCN titer for Cu. After this value is determined, the Schweitzer reagent can be easily and quickly evaluated. About 10-15 cc. of the Schweitzer reagent is taken for the determination, and titrated in the same way, the per cent of Cu being then calculated. The results are very accurate.

The ammonia value is determined by the Kjeldahl method, as usual.

The author concludes, from his studies, that the amount of free ammonia has little or no significance, i.e., that one can use ammonia-water of strengths from 6% to 25%. A value below 6% leads to the formation of a precipitate in the generating flask, and also is accompanied by poor keeping qualities of the reagent. According to the duration of the passage of the air, the reagent is richer or poorer in copper. In 20-30 minutes, the percentage of copper becomes about 0.6-0.7%; after 3-4 hours it becomes 4.0-5.0%—a strength which is much too concentrated for microscopical tests. Such a strong solution to be sure, can, be diluted with ammonia-water, but it is better, on the whole, to get the desirable lower strength by passing the air through the ammonia-copper only long enough to get the desired percentage at once. The solvent-power of the reagent upon cellulose is governed solely by the percentage of the copper. The reagent will keep well if 10-15% of ammonia be the concentration for that component.

In working with cotton, the reagent should have a copper content of 0.55%, or 5.5 g. per liter. This strength does not bring about a complete solution of the fiber, but only a strong swelling. If the cuticle of the fiber is in good condition, the fiber will present the appearance of an irregular string of beads, the cuticle in places holding tightly, as a collar, about the interior of the fiber, and there restricting it to its original thickness, while in other places the swelling is sufficient to burst the cuticle, the substance of the fiber then swelling out into more or less spherical outlines. If the cuticle has been weakened by prolonged immersion in caustic soda solution, e.g., of 16%, at ordinary temperatures, for 24 hours, it will have lost its tensile strength and will swell up uniformly with the rest of the fiber. The cuticle can then be observed as spiral markings on the fiber. When the cuticle has been completely destroyed, the fiber swells uniformly, and no markings are visible upon it. Such a case is presented by fibers which have been transformed to oxy- or hydro-cellulose.

If a Schweitzer reagent of 0.68-0.70% Cu is employed, the limits of the daily growth of the fiber are perceptible in the swelling fiber. If the reagent is of 1.2-1.3% in copper, the fiber dissolves quickly and completely. Such a strength of reagent is of use only for distinguishing plant fibers from animal fibers. With a Cu content of 1.0%, the cuticle of cotton fiber can be preserved while the cellulose (the internal substance) dissolves completely. The cuticle remains in the form of transparent rings and bands. If the copper content is less than 0.4%, the reagent has no perceptible influence upon the fiber.

Bast fibers behave in a generally similar way. The concentrated reagent (1.3% of copper and higher) dissolves these fibers completely and rapidly. For examination of the elementary fibers of linen, hemp, and other such materials, the reagent should contain 0.35-0.40% of Cu. This strength permits the determination of the degree of damage which they have suffered, as well as the determination of other points. A strength of 0.55% of copper brings about a rapid and uniform swelling of such fibers, and is of little value.

Wool, Treatment of, for Increase or Decrease of its Affinity for Acid or Neutral Dyestuffs

German Patent No. 432,111 — *I. G. Farben-Ind. A. G.*—The substances mentioned are those recommended in German Patents Nos. 400242, 406675, 409782, and 409783,—sulphurized products of phenol. These are used alone or in conjunction with tin salt, and the goods are either pretreated with the agent, or this is simply added to the dyebath, or the goods may be treated first with the organic reagent, and afterward with tin salt before dyeing. If the product of example 1 of G. P. No. 406,675 is

used in this manner, the wool is reserved, and may be used for white or colored effects in weaves.

Cross-Sections of Fibers, Quick Method of Preparing

Dr. A. Herzog—Kunst-Seide 12, 92 (1930).—A fine crochet-needle is forced through a small, good cork as free as possible from grit, until the tip projects well beyond the further side. A strand of thread is then looped into the eye of the needle, and the needle drawn back out of the cork, so that the loop of thread now projects from the side of the cork first perforated. This loop of thread is used as a snare with which to draw a bundle of the fibers to be examined (a bundle of a suitable number of the fibers) through the perforation in the cork. Thin sections are then cut transversely through the cork with a sharp razor. The elasticity of cork makes possible a firm gripping of the fibers even in very thin slicing of the cork.

For examination under the microscope, one of these cork disks, gripping the extremely short cross-cut bundle of fiber, is "homogenized" upon its surface, by laying it upon a cover-glass with the fiber-ends in the perforation upon a drop of immersion-fluid resting upon the center of the cover-glass. Any excess oozing out around the edge of the cork disk is removed with a wisp of blotting-paper or filter-paper. The cover-glass, with the cork disk etc. adhering, is then inverted and laid upon an object-slide which has either been ground out to a shallow circular trough, or has a glass ring of low height cemented upon it (the application of the hanging-drop principle in bacteriological work). Water or glycerol are the imbedding-fluids mostly used, of course Acetate-silk gives the best results with water; with other artificial fibers, concentrated glycerol or pure paraffin oil is better.

Several reproduced photo-micrographs illustrate the article. (By the way, can a photo-micrograph ever be obtained so entirely free from defects, diffraction-disks, etc., as would appear from most reproduced photo-micrographs? We should like sometime to see a frank admission that the retoucher has done his work before the plate is made for printing. We do not refer particularly to the cuts in this paper, which are of high excellence; it is a question long in mind.) A number of valuable hints, perhaps not needed by the skilled worker, close the article.

United States Institute for Textile Research

The meeting in New York, May 23, having adjourned subject to the call of the Committe on By-Laws, consisting of Dr. E. H. Killheffer, chairman, P. J. Wood and C. H. Clark, and that committee now being ready to report, the acting secretary has notified the preliminary Board of Directors that a meeting for tentative adoption of by-laws and for temporary organization of the Institute will be held at the Chemists' Club, New York City, Tuesday, July 29 at 1:30 P. M. A copy of the revised by-laws is being sent to each director for study prior to the meeting. It is considered highly important for every director to be present, not only for the purposes mentioned, but also to take action regarding the presentation to the directors of the Textile Foundation of specific research needs that should merit the latter's financial support.

General Fast Blue R R Base

The General Dyestuff Corporation has introduced a new developing agent in Fast Blue R R Base. This product is light and medium strengths. It is said to yield bright redish-blue to blue-violet shades, and in full strength bloomy navy blue shades of great body.

Its suitability for most methods of dyeing, its bright shades, and its very good fastness to light, washing, boiling and chlorine are the advantages claimed for this product.

In combination with Naphtol AS-SW it is recommended as being of excellent fastness to caustic soda boiling and chlorine, making it particularly useful for goods to stand severe boiling and for colored fabrics to be bleached.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

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